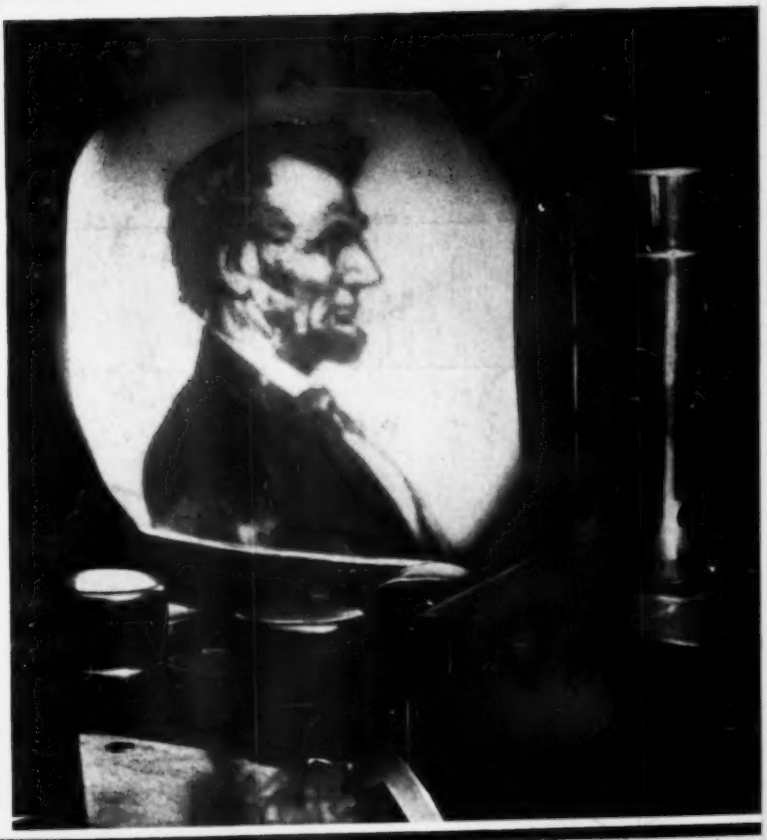
QST—

amateur radio



A Hound's Tooth . .

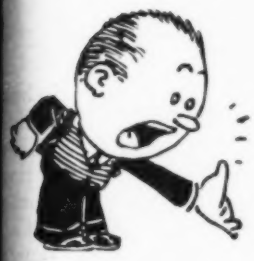
is not as clean as the design of the 30J r-f section. Every piece of metal and ceramic bespeaks simplicity and performance.

COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA NEW YORK, N. Y: 11 WEST 42 STREET

QST *devoted entirely to* AMATEUR RADIO

PUBLISHED, MONTHLY, AS ITS OFFICIAL ORGAN, BY THE AMERICAN RADIO RELAY LEAGUE, INC., AT WEST HARTFORD, CONN., U. S. A.; OFFICIAL ORGAN OF THE INTERNATIONAL AMATEUR RADIO UNION



MARCH
1938

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★

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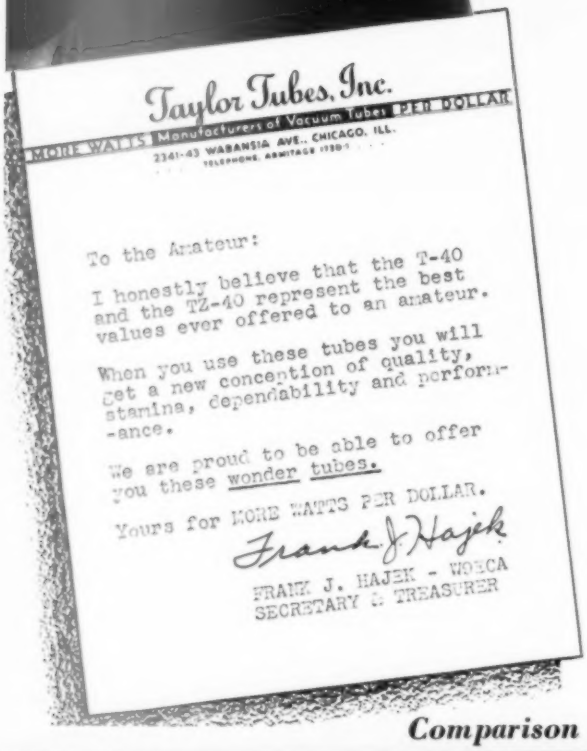
The Contents

TWO NEW

WONDER TUBES

TZ-40

A high Mu zero bias Triode offering wide possibilities in Class B Audio operation and as a high power doubler and buffer. 175 watts of Class B Audio output with 3 watts drive! As an exciter it will drive efficiently an amplifier stage to 700-800 watts input. Complete technical bulletin for the asking — at your Distributor or write us.



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I honestly believe that the T-40 and the TZ-40 represent the best values ever offered to an amateur.

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Yours for MORE WATTS PER DOLLAR.

Frank J. Hajek

FRANK J. HAJEK - W9BCA
SECRETARY & TREASURER

TZ-40

GENERAL CHARACTERISTICS

Filament	7.5 volts
Filament current	2.5 amps
Amp. factor	62
Plate to Grid cap.	4.5 MMF

CLASS B AUDIO OPERATION
(Values for 2 tubes)

Plate Volts	1000
Bias	0
Peak A.F. Grid to Grid voltage	220
Zero signal DC plate current	44 MA
Max. Sig. plate current	280 MA
Plate to plate load	6800 ohms
Av. Driving Power	3 watts
Power output	175 watts

CLASS C OPERATION

Plate volts	1000
Plate current	115 MA
Grid volts	–45
Grid current, Max.	35 MA
Driving power, Max.	10 watts

OVERALL DIMENSIONS

Max. length	6½
Max. diam.	2

Comparison Sells Taylor Tubes

Taylor HEAVY CUSTOM BUILT DUTY Tubes

"It Seems to Us——"

THE critical season when most communications emergencies occur is again upon us. Floods, hurricanes, sleet storms—the threat of broken wires and consequent intelligence gaps in the last months of winter imposes heavy responsibility on amateur radio.

Amateurs have provided emergency communications at such times for nearly two decades. Until recent years, theirs have been largely performances of individual heroism—deeds of valor performed single-handed or by comparatively small groups. It is only in the past two or three years that the concept of amateur radio, as an entity, taking over the bulk of emergency communications activities whenever existing services are overloaded or disrupted, has achieved form. Now that concept is coming to be accepted, not only among amateurs but by other radio services and government and relief agencies as well.

It should perhaps be stated, parenthetically, that in speaking thus of "amateur radio" we are using the broadest definition. Amateurs have many affiliations; much "amateur" emergency activity is nominally directed by such authorities as the Signal Corps, Naval Reserve, National Guard, even the Coast Guard and Army Engineers, as well as municipal and semi-private agencies. But in a realistic sense these groups are all affiliates of amateur radio; they are dependent upon amateurs for operating personnel; and to a major extent they utilize amateur frequencies and operate under amateur status. Their sole connecting link is amateur radio. The amateur is the yeast that leavens the whole batch of bread; without him the individual groups could not exist.

The keynote of all our emergency communications system is, therefore, the amateur. The responsibility is likewise his. This responsibility makes imperative the exercise of forethought and preparedness. Occasionally one hears optimistic assertions on the part of private or governmental agencies that professional emergency communications corps are being or will be organized, to avoid the haphazardness of amateur methods. A little simple arithmetic will show the impracticability of any such ambitious plan; the facilities simply aren't available. To establish a system of minimal utility several thousand units would be required. More or less regular drills would be essential to provide the consistent practice essential for proficiency. The cost would be staggering. Apart from that, the wastage in radio channels would be prohibitive.

But the fact that such plans are even broached indicates a lack in the amateur system, however. Further evidence of such a lack is the implied desire on the part of certain agencies following the Ohio River flood last year to take over the *administration* of amateur facilities in future emergencies.

And there lies the key to the lack. It is one of administration—*organization*. Our facilities have been more than adequate; we have thousands of skilled operators, we have permanent stations located in nearly every community, and we have many hundreds of units of portable self-powered equipment developed in recent years as a result of A.R.R.L.'s Emergency Corps and Field Day campaigns. Beyond that, we have amateur and amateur-affiliated networks covering the entire country.

All that has been lacking has been centralized organization—coördination. In past emergencies such centralized, coördinated control has evolved spontaneously in some regions; in others, inefficiency, duplication of effort, and confusion and delay have prevailed. In the future we cannot depend on accident. We must have efficiency and reliability and complete coverage from the very start. We must prepare adequately, not only with personnel and equipment, but with organization.

For the past seven months A.R.R.L. has been working on this problem. For the most part it has been a process of working out details in the broad general plan, expanding the program of the A.E.C. of the past several years, providing a skeleton framework of organization to serve as a rallying point for mobilization in time of emergency need. Recommendations to the F.C.C. to aid the amateur service in its organized capacity to serve the public were made by the Board last May. About December 15th the nucleus of the plan—the appointment of Emergency Coördinators in all communities of sufficient size—was gotten under way; by the end of January some sixty coördinators had already been appointed.

The details of this plan have already been circulated through Communications Department bulletins, and will be the subject of a detailed article in the next issue of *QST*. Every amateur should examine this article with care, for it is of great importance to the future of amateur radio.

—*C.B.D.*

Canada—U. S. A. Contact Contest

April 14th, 15th, 16th, 17th and 18th

WHAT a glorious weekend of operating that will be, 102 hours for renewing old friendships. Records of previous years should be topped this year. Last year VE3GT won a lovely trophy fourteen inches tall, which was donated by Canadian Marconi Co. This year, The Canadian General Electric Co. is donating a cup to go to the highest scoring Canadian station. Other Canadian manufacturers are donating prizes in equipment to go to the next three or four highest stations. Canadian General Manager Alex Reid, VE2BE, has heartily endorsed this year's contest, which is being sponsored by the Section Communications Manager of Ontario, Fred H. B. Saxon, VE3SG. Logs should be mailed to him at 302 Lee Ave., Toronto, Ontario, not later than midnight April 30, 1938.

THE CONTEST RULES

Dates: Starts—Thursday, April 14th, 6 P.M. local time. Ends—Monday, April 18th, midnight, local time.

Duration: 102 hours.

Frequency: Any or all amateur bands may be used.

Object: Each VE will work as many W stations as possible in as many United States A.R.R.L. sections (see list page 6, *QST*) as possible. Each W will work as many VE stations in as many VE sections as possible.

Scoring: The same log form as used for last year's contest will be used. Message preambles will be exchanged. Each preamble sent will count one point and each one received will count one point. It is not necessary for preambles to be exchanged BOTH ways before a contact may count, but one must be sent or received before credit is claimed. All preambles must be handled under approved A.R.R.L. procedure. Mark each new section as it is worked. The "check" portion of the preamble will be the RST report of the station worked. Sample preamble: NR 1 VE3GT CK 579 Toronto, Ont. 6.02P Apr. 14. W Stations multiply number of points by the number of VE sections worked and multiply the final score by nine, there being nine times as many U.S.A. sections. VE stations multiply the number of points by the number of U.S.A. A.R.R.L. sections worked.

POWER AND OPERATOR HANDICAP

Each station having less than 100 watts input to the final stage shall multiply the score by 1½. Where more than one operator normally operates a station the total score of the station shall be accepted, providing a certificate is attached to the log giving the names and call signs of the operators making the score.

PRIZES

A.R.R.L. Certificates of Merit will be awarded to the leader in each of the 70 A.R.R.L. sections in the U.S.A. (and possessions) and Canada. Suitable prizes for a limited number of Canadian leaders will be available. The Canadian General Electric Co. are donating the main prize this year, a cup, which will be known as The C. G. E. Trophy. The sponsor will not be in the running for a prize, but will be on the air to give points to aid W stations in obtaining a higher score.

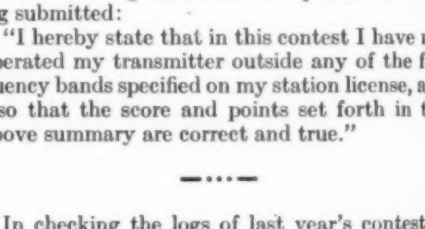
OPERATOR'S CERTIFICATE

The following certificate is requested on each log submitted:

"I hereby state that in this contest I have not operated my transmitter outside any of the frequency bands specified on my station license, and also that the score and points set forth in the above summary are correct and true."

—···—

In checking the logs of last year's contest it was noticed that every A.R.R.L. section had active participants, yet there were six sections from which no logs were received. This year the sponsor would like to be able to issue certificates of merit to each of the 70 sections. W6ITH led the U. S. contingent last year with 101 contacts, 93 of which were made on 'phone, all seven Canadian sections being worked. This was splendid work, but, never being satisfied, we are looking forward to some one bettering it this year.



CQ WCFT*

Further Adventures Aboard the "Yankee"

By Alan R. Eurich,** WCFT-W8IGQ

BACK in 1936, just before spring started thinning the ranks of the brethren, while slaving away trying to absorb a little book knowledge I read an article written by Captain Irving Johnson recounting some of the experiences he had had with a crew of young fellows on his schooner circumnavigating the globe two years before. The idea of his cruise had been to take boys, mostly of college age, on what amounted to a "share-the-cost" basis, and sail around the world. These fellows also served as the crew.

Having a bit more than the usual touch of adventurous spirit in his blood, Irving Johnson took his ship into many of the out of the way places seldom visited in recent years. Among other things he did on that first cruise was to discover five new islands in the Pacific and chart them, to weather an Indian Ocean cyclone, and to discover a major waterfall in British Guiana over five-and-a-half times as high as Niagara. However, from my point of view, one serious error had been made—they carried no radio. In fact, several times during the cruise folks at home began to worry over them when the *Yankee* was unable to follow the schedule that had been laid out before leaving America.

Photos by Edmund Zacher

NATIVE DRUMS KEPT THE CREW AWAKE ONE NIGHT IN THE NEW HEBRIDES

Investigation the next day disclosed these offenders.

Captain Johnson's closing words were: "I hope to leave Gloucester (Mass.) again with another group of boys November 1st, 1936, for a similar cruise." I inquired for further details. The idea sounded good to me as I had become rather fed up with classes and the like.

After due preliminary negotiations, during which I looked over the boat and was looked over, I finally signed on for the coming world cruise. As a ship the *Yankee* was a 92-foot, two masted schooner, built some forty years ago by the Dutch Government for pilot service on the North Sea. The old pilot service orders were to stay out until no other vessel could. By that time the pilot ship could not risk coming in close to shore, so she was literally built for all kinds of weather. In those days she had no power and had to rely on her sailing ability alone. To-day she is as sound as the day she was commissioned though time has seen a few minor changes. Below, she has been refitted to make living conditions more comfortable on long cruises in the tropics. A 35-h.p. semi-Diesel motor makes for easier maneuvering at docks and through narrow passes. Another addition to the ship's original gear is the radio antenna, which runs from the lead-in bowl in the deck near the base of the mainmast to the main spreader. The antenna is a vertical 55-foot Marconi.

I had been told before signing that if I finally went on the trip, the "Skipper," as I soon came to call Captain Johnson, would see that there was radio equipment on board. Some personal friends of his had been trying to sell him the idea that high-frequency radio on a small boat was very practical, but Captain Thompkins of the *Wander Bird*, KMUP, whom the Skipper knew well, had not had much success with his attempt. We ended up with a compromise between what I wished to have and the Skipper's idea of cost. This amounted to an old m.o.p.a. designed for service ten years ago on 100-meter c.w., which I rebuilt to work on the high-frequency ship bands. With an 801 driving p.p. 801's I was supposed to get an output of about 75 watts. The receiver was a Sargent model 12 which I chose because Walter Evans of Westinghouse Radio Division warned me from his experiences that moisture troubles would be very bad. The makers advertised the model 12 as having been made primarily for shipboard use. Now, I wish that I had bought two receivers—keeping one in the oven drying out while using the other.

Previous to sailing I had decided that here was a good chance to see what amateur radio could do when it came to rendering daily long-haul traffic contacts without the aid of high power and

*Written on board the schooner-yacht "Yankee" in mid-Indian Ocean.

**4138 Oak Knoll Drive, Youngstown, Ohio.

directional antennas at both ends. I made arrangements with several stations in various parts of the world for schedules and spread the word in general that while legally WCFT was a ship station licensed for communication with amateurs, actually she was an amateur station operated by an amateur and would be in communication with amateurs. Unfortunately, even after making some trips to Washington to see the F.C.C. people personally, I was unable to get permission to operate in the amateur bands. The best they could do for me was to indorse the licenses in the same way as for Byrd—permitting amateur contacts under the call WCFT but requiring us to operate on regular ship frequencies. Therefore, many stations who would have liked to have carried schedules were unable to, because their receivers were made to tune the amateur bands only.

When we sailed on November 1, 1936, I had skeds with the following: W8PH, W1ZB, W3BQP, W8IUF, G6NJ, K5AI and VP5JB. In addition I was to work VS1AA and ZS2X when I got within range of them. Unfortunately, difficulties with the installation required that I carry a skeleton schedule with W1ZB only.

Right here Carl Madsen, W1ZB, should come in for his bow. He heard of the *Yankee's* cruise shortly before we sailed and wrote offering his services, as he felt that, aside from having a good station with a modest DX record, he was in a position to give WCFT quick service to our home office which was in Springfield, Mass. He came down to Gloucester while we were outfitting, to say "Hello," and made a flying trip the day we sailed, to calibrate the transmitter. Since then he has given far better coöperation than I could have hoped for. He has been on daily for over a year right on schedule. Once a breakdown threw us off the air for a week, but he was still faithfully at it when we got back on. If for some reason he had to leave town he would get W1FTR or W1CC to fill in for him. However, it was usually ZB who was there. No matter what time it was or what condition that New Year's celebration had left him in, he would still be there when the clock rolled around to sked time. This was a fine example of the true ham spirit that so many people claim is dying out.

THE AUTHOR HARD AT WORK MOVING TRAFFIC FROM WCFT TO W1CC

This picture was taken while in the Aru Islands in the Dutch East Indies.

I also want to thank Oakes Spaulding, W1FTR, who spent so many early mornings standing by in Hartford when my signals got so weak that his slightly superior location often made the difference between getting a message or having W1ZB struggle to hear it through a maze of electric shaver QRM again. W8IUF receives our thanks for giving a wonderful QSP to many of the families of those on board. The same applies to W8AAU. K5AG, with operator Snow behind the controls, spent many early hours handling traffic to and from the *Yankee.* W6LPZ and W5FSE made possible several direct chats with my folks while they were on an extended trip and some personal business needed attention. To W1TS, W1SZ and W1NI I want to give thanks for many a pleasant chat. It was a great pleasure to chat for a minute or two in good old ham style with various stations and I am only sorry that the supply of energy in the ship's batteries wasn't large enough to permit some old-fashioned rag chewing. The following also did their part to render various bits of assistance in one way or another during the course of the cruise: W8HAR, W8PH, W9ALV, K5AA, K5AV, KA1FM, K6NXD, K6OJG, NY2AC, FO8AA, VS1AD, VS3AE and ZE1JG.

I had had doubts of what the little 75 watts could do on such long haul contacts, and while its performance far exceeded even my wildest hopes, there were times nevertheless when I was unable to work through. In fact, no amount of power would have broken down the barrier. A synopsis shows that from Gloucester, Haiti, Panama, Galapagos Islands, Easter Island, Pitcairn Island to Tahiti we had S9 or better signals from the U. S. A. Our signals in turn were sufficient to insure good solid contacts except when broken up by the heaviest QRM in the ship bands. Naturally we reached Panama a little better than the U. S. A. but the QRM from all the shipping passing through the Canal made matters even worse than in New England. At Papeete, Tahiti, we experienced our first slump in the strength of U. S. signals. This, however, I lay to local conditions, for as soon as we left there and went on towards Christmas and Fanning Islands the signals came back up to their former level. However, by the time WCFT reached Pago Pago the signals had dropped off again and, combined with very poor local conditions from surrounding mountains, caused the first break we were to experience. Nevertheless we continued to have contact by combined use of 36 and 18 meters. After experiments early in the trip, during which we tried 8.2, 11, 12.4 and 16.5 Mc. and both 7 and 14 Mc. for the home end, we found

that 8.2 and 16.5 Mc. used in conjunction with 7 and 14 Mc. respectively gave us the best results. Gradually, as summer static increased during May, 1937, on 36 meters in the U. S. A. we shifted all of our operation to the higher frequencies. For the first time during the trip the signals at both ends began to show the effects of the "DX Cycle." While they did not conform exactly to Perrine's findings they did show that there was a definite cycle. Finally, after calling at the New Hebrides, Solomons, New Britain and Papua, we cleared through Torres Straits and that night, entering the Arafura Sea, we had our last contact with the States on 36 meters. Strangely enough, it was with my own station, W8IGQ, using only 100 watts on 40 meters. Two nights later not even West Coast signals came through. From then on, as we progressed through the Netherlands Indies, we had difficult contacts at intervals on 16.5 Mc. We still heard W1ZB, and alternates, on 14 Mc. but only S3 and 4. At this time we started to clear traffic through KA1FM in Manila. We continued to have occasional contacts with the East Coast direct until the *Yankee* left Semarang, Java, which was the last time we were to hear the New England gang for some time.

After a lay-off at Singapore while I left the ship for a trip to Siam, I continued to work KA1FM, but I was unable to hear the United States at all on any frequency. I am referring to amateurs, for KPH and KFS came through, although weakly in comparison to the power they are using. As the *Yankee* rounded the north end of Sumatra, however, the signals from the U. S. just burst through on 14 Mc., not at the 1000 to 1300 GT period that we had been using up to this time but about 0000 GT. 'Phone and c.w. came through equally loud. I notified W1ZB as soon as I felt certain that these conditions were not temporary. In mid-Indian Ocean I suddenly lost KA1FM. All KA signals dropped out. Five days later I raised W1FTR on 16.5 Mc. and had a solid QSO. Daily contact was established and, though the time that W signals came in shifted very rapidly as WCFT moved across the Indian Ocean, the strength of signals at both ends remained good for some time. The Chagos Islands found the peak on 14 Mc. about 2230 GT while the area off northern Madagascar found it some place between 2100 and 2215. About this stage of the trip KA signals started to come in again, but very weak in comparison to their former strength. Also W's came in during the 1200 GT period, but not nearly so well as the other way around. For that matter W's could be heard on 14 Mc. any time from 1200 through to 0400 GT on good days. This may all sound rather confusing but it should serve as a fairly accurate guide to help those figuring the correct time to listen for those sparsely settled areas of the globe. As this is being written the *Yankee* is approaching the island of Zanzibar. Here conditions have taken a drastic

THE "YANKEE" LIES AT ANCHOR AT BARTHOLOMEW ISLANDS IN THE GALAPAGOS

shift and no signals except South Americans, which are strong, are heard between 2000 and 0300 GT on 14 Mc. Conditions are similar on 7 Mc. This sudden slump is probably due, however, to the approaching winter solstice.

Now let's get away from the subject of radio and look at the other side of the cruise. Here was a year and a half of good fun with no worries. Room and board had been paid at the start and would not bother us until the cruise was over. Just think of a chance to forget two winters and slide quietly along in the tropics, literally on the wings of the wind! After the first few days of getting used to such minor items as the motion of the ship, we got out of the North Atlantic, just beginning to feel winter's hoary finger, and soon sailed into Cape Haitien, Haiti, famous as a rendezvous of Christophe, the black Napoleon of French Colonial days. Then we sailed to Panama for last-minute supplies. This seemed to us to be the final jumping-off place. Here we would leave all civilization such as we had known and drop into a world totally new. In our passage down we had had a taste of sailing. We had sometimes drifted lazily along with hardly steerage way. The hot tropical sun beating down made us lazier every minute. At times we tore along through the night with the deck lashed by driving spray, the wind howling in the rigging. Suddenly all hands would be roused out of a sound sleep to rush on deck, dressed just as they slept, to fight flaying canvas and gear—one hand for themselves and one hand for the ship. Oh, this trip was varied enough to suit anyone.

From Panama we eased slowly down across the Gulf of Panama to the strange Galapagos Islands, which Beebe truly called "The world's end." They are a great natural zoological garden, marine aquarium and geological wonderland all rolled into one.

Then we crossed the great Pacific to Easter, Pitcairn, Manga Reva and Tahiti.

At Tahiti and some of the other Society Islands such as Moorea we found some of the beauty spots of the Pacific. Here was the home of beautiful,

(Continued on page 84)

A Feed-Back Compensator for R.F. Circuits

Controlled Negative Feed-back in the Receiver R.F. Amplifier

By H. O. Talen,* W9PYQ

IN receivers using a tuned radio-frequency amplifier, the design usually includes no deliberate feed-back from the succeeding stage to the first grid circuit. Sometimes a regenerative feed-back coupling is provided, with marked advantages under certain, but not all, conditions. There seems to be a perennial argument as to whether a regenerative r.f. stage is "constitutional" or not, particularly in a superheterodyne using more than two or three tubes. There is little doubt that feed-backs do occur except when the r.f. stage is neutralized either by accident or by careful adjustment. Let us consider the question further in terms of a circuit in which we can choose any required degree of positive or negative feed-back, in addition to those already existing.

THE CIRCUIT

In Fig. 1 we have a tuned radio frequency stage followed by a regenerative detector, probably the world's toughest spot for a tuned amplifier. The cathode is connected to potentiometer R_1 (500 ohms) across a small winding coupled to L_1 and having its center point grounded. For lack of a better handle, we call the potentiometer and associated circuit a "feed-back compensator." By swinging the arm to "A" the cathode is in effect tapped up on L_1, and the result is a *regenerative* electron-coupled circuit of the Hartley type, if the coils are wound in the same direction. Swung to the other end, the arm connects the cathode to the coil at "B" in such a way as to feed back *degeneratively* any signal impressed on the grid. As expected, the latter setting reduces the signals to a degree which experience shows is dependent upon the voltage and phase of other feed-backs. Of course, the potentiometer can be set at any intermediate point desired, with corresponding results.

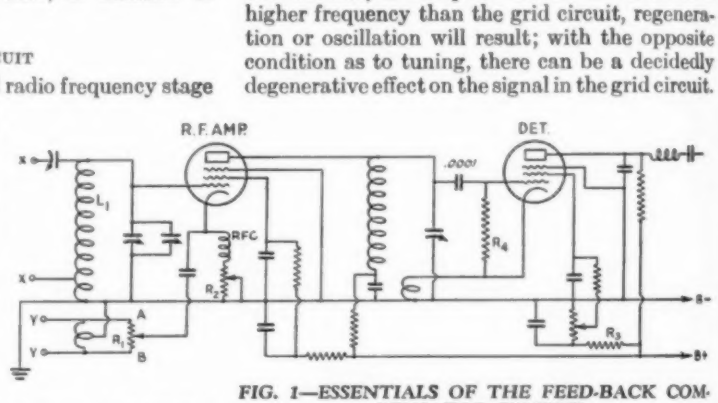


FIG. 1—ESSENTIALS OF THE FEED-BACK COMPENSATOR CIRCUIT

R_1—500-ohm potentiometer (feed-back compensator).
R_2—R.f. gain control.
R_3—Regeneration control.
R_4—1-megohm leak.
X-X and Y-Y—Alternative antenna connections.

CONDITIONS AFFECTING OPERATION

The first grid circuit is affected by several factors, among which is the antenna "load." Like the weather, we rarely do anything about it. If the antenna is resonant at the received frequency, the grid circuit tunes broadly and usually behaves itself with almost any degree of regeneration in the next stage. Not so when the antenna frequency or a harmonic differs from the received signal. By appropriate setting of the feed-back compensator, it is possible to offset a heavy antenna load with regeneration, and to nullify any dead spots in the tuning range. By a different setting, any unwanted oscillation of the r.f. stage due to a light load and advanced regeneration in the detector can be eliminated.

In unneutralized high-frequency amplifiers there is always a transfer of energy through the grid-plate capacity of the tube. The phase of this feed-back depends upon the relative tuning of the two circuits; if the plate circuit is tuned to a higher frequency than the grid circuit, regeneration or oscillation will result; with the opposite condition as to tuning, there can be a decidedly degenerative effect on the signal in the grid circuit.

Published tube data show that the plate-cathode impedance of an r.f. pentode is higher than the load impedance furnished by even the best of parallel-tuned circuits. Part of the disparity can be eliminated by regeneration in the second stage. In order to take full advantage of the gain obtainable from an r.f. stage, the regeneration in the second stage must be carried somewhat farther than is usually permitted because of trouble from oscillation in the first stage. The desired result can be secured by stabilizing the first r.f. stage with a judicious bit of negative feed-back.

By gradually introducing more negative feed-

(Continued on page 68)

* 5532 Tennessee Avenue, St. Louis, Mo.

A Double-Regenerative Superhet

Low-Cost Five-Tube Receiver with Stability and Selectivity

By Byron Goodman,* W1JPE

ONCE upon a time all amateurs built their own receivers, simply because that was the only way they could get them. But that was once upon a time, and nowadays, with the many excellent receivers available on the market, a fellow has to have a fairly good reason for building one. One's pocketbook usually supplies a very good reason; sometimes it's a fellow's pride, and every once in a while it's because some upstart thinks that the commercial receivers are still not as perfect as they might be from an amateur's viewpoint.

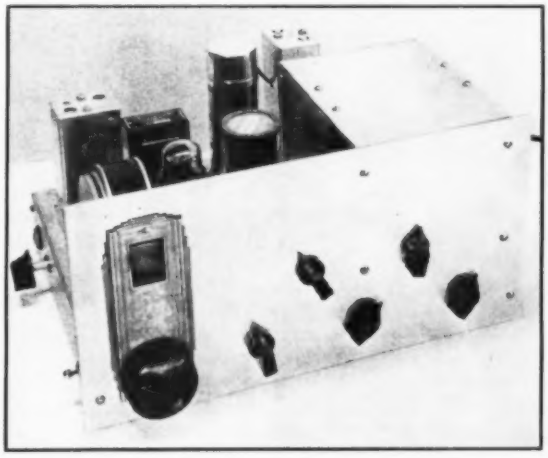
Let's take the case of the fellow with the small pocketbook. Likely as not he is using a t.r.f. or even a detector-and-one-audio, both excellent receivers when there isn't too much QRM. But when the going gets tough one really needs a superhet—not necessarily because of any greater sensitivity but because of increased selectivity plus the fact that a superheterodyne won't lock up on strong signals the way an oscillating detector will. But our friend with the already-strained pocketbook can't afford an elaborate receiver, and therefore must compromise as much as possible. And although he can compromise still further than was done in the receiver to be described, it is our feeling that the technical disadvantages will outweigh the few economic advantages.

CIRCUIT FUNDAMENTALS

From the compromise standpoint, it seems that the receiver should have at least five tubes. The mixer and h.f. oscillator are of course essential and should be separate tubes. The customary i.f. amplifier can be eliminated and only a regenerative second detector used for gain and selectivity, but a separate beat-frequency oscillator should be used if we are to avoid the "locking-up" trouble that is the disadvantage of oscillating detectors. An audio stage is necessary as a suitable coupling to the headphones or speaker, and provides an excellent place for the volume control. The receiver should use a 1600-kc. i.f. to reduce the image response, and a regenerative mixer to increase the gain in the all-important "front end." One more thing: a high-*C* high-frequency oscillator circuit should be used for stability, but a low-*C* signal circuit should be used for maximum gain, ganged together by the system described in an earlier issue of *QST*.[1] That the high-C oscillator is well worthwhile is shown by the fact that the plate voltage on the set can be varied 50 volts with a resultant change in signal beat of only about 500 cycles on 14 Mc.

The tubes practically selected themselves for this receiver. The 6L7G seemed to be the only choice for the mixer because of its excellent characteristics and lack of necessity for critical adjustment of oscillator voltage. A 6J7 might have been used, but the oscillator coupling would have been more critical.

Previous experience had shown the 6J5G to be an excellent high-frequency oscillator tube, and its use in this receiver again justified its reputation.



THE DOUBLE-REGENERATIVE SUPERHET

A simple five-tube receiver for the amateur who wants a maximum of receiver performance with a minimum of cost. A larger knob has been placed on the drum dial to facilitate tuning. The b.f.o. adjustment can be seen at the rear of the receiver, on the left-hand side.

A 6K7G was used for the second detector because it goes in and out of oscillation a little more smoothly than a 6J7G. A metal 6K7 was used for the b.f.o. tube, and the 6C5 seemed logical for the audio tube, although no doubt a 6F6 or even a 6L6 could be used if real audio watts were desired. However, for usual headphone reception the audio volume control is set at about ⅔ off, so the audio output was considered to be ample.

* Assistant Secretary, A.R.R.L.

[1] Goodman, "A 56-Mc. Converter of High Stability," *QST*, August, 1937.

ELECTRICAL DETAILS

A glance at the circuit in Fig. 1 will show that most of the details are straightforward and conform with usual practice. The No. 3 grid of the mixer tube is coupled directly to the grid of the high-frequency oscillator, and the tight coupling doesn't seem to impair the stability at all. The mixer and oscillator tuning circuits are bandspread by the usual tapped-coil method, with the additional feature of a high-*C* oscillator circuit for stability and a low-*C* signal circuit for gain. Very little difficulty was experienced in winding the coils, although the completeness of tracking will depend entirely on the patience of the builder. However, since the mixer padding circuit is adjustable from the panel, it is not necessary to make the two circuits track exactly. If the coil dimensions given are followed closely, the tracking will be quite good.

It will be noted that the regeneration control for the mixer is a variable resistor placed between two fixed resistors. This gives a variation in screen voltage in the mixer of from 50 to 200 volts instead of the usual 0 to 200 volts, and gives a slight "vernier" effect to the regeneration control.

The second detector employs a tuned cathode circuit for regeneration, saving the trouble of winding a special i.f. transformer. The detector is coupled to the audio tube by means of a 0.1-μfd. condenser and a 500-henry choke. Suitable r.f. filtering is used before the high-inductance choke, and there is no "motorboating" or "howling."

One thing may appear a little unusual. There is no connection between the b.f.o. and the second detector. This results in slightly-below-optimum coupling between oscillator and detector for strong signals, with consequent "limiter" action. However, the coupling is just about right for weak signals, with the result that the signal-to-noise ratio appears to be exceptionally good, and always brings forth the comment that the receiver seems to be nice and quiet. Such is of course the case, and on strong signals it is only necessary to back off the front-end gain by reducing the regeneration or detuning the mixer, and increasing the audio gain to give excellent signals for copy. If it

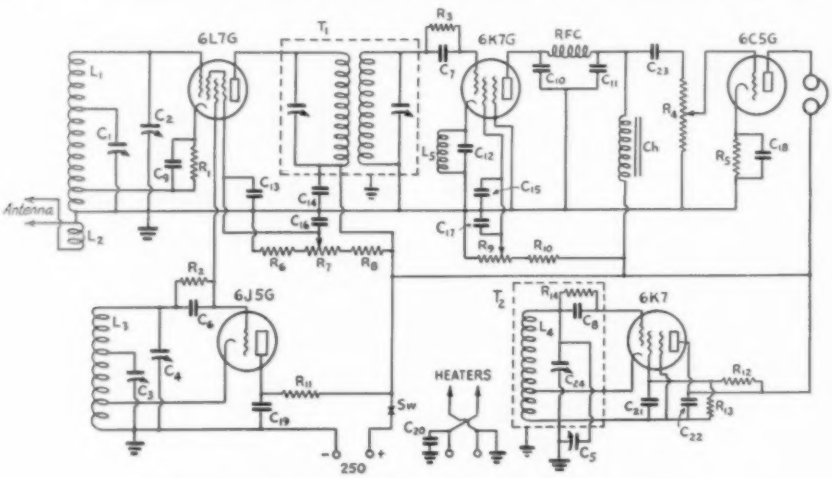
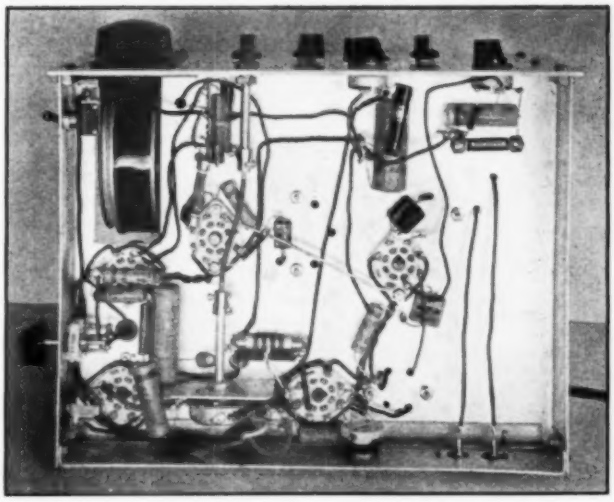


FIG. 1—CIRCUIT DIAGRAM OF THE RECEIVER

C_1—*15-μμfd. tuning condenser (Hammarlund HF15).*
C_2—*35-μμfd. bandset condenser (Hammarlund HF35).*
C_3—*35-μμfd. tuning condenser (Hammarlund MC-35-S).*
C_4—*100-μμfd. bandset condenser (Hammarlund HF100).*
C_5—*2-plate midget variable for beat-note adjustment (Sickles ATR-21).*
C_6, C_7—*100-μμfd. mica.*
C_9, C_{10}, C_{11}, C_{12}—*250-μμfd. mica.*
C_{13}—*0.005-μfd. mica.*
C_{14}, C_{15}—*0.01-μfd., 400-volt paper.*
C_{16}—*0.1-μfd., 400-volt paper.*
C_{17}—*0.5-μfd., 400-volt paper.*
C_{18}—*5-μfd., 50-volt electrolytic.*
C_{19}—*0.005-μfd. mica.*
C_{20}, C_{21}, C_{22}—*0.01-μfd., 400-volt paper.*
C_{23}—*0.1-μfd., 400-volt paper.*
R_1—*500 ohms, ½-watt.*
R_2—*40,000 ohms, ½-watt.*
R_3—*0.25 megohm, ½-watt.*
R_4—*0.5-megohm potentiometer.*
R_5—*1000 ohms, 1-watt.*
R_6—*25,000 ohms, ½-watt.*
R_7, R_9—*15,000-ohm wire-wound potentiometer. (Yaxley C15MP. Rotor must be insulated from panel.)*
R_8—*500 ohms, 1-watt.*
R_{10}—*30,000 ohms, 10-watt wire-wound.*
R_{11}—*10,000 ohms, 1-watt.*
R_{12}, R_{13}—*15,000 ohms, 2-watt.*
RFC—2.5-mh. choke.
L_1, L_2, L_3—*See coil table.*
L_5—*2.5-mh. choke.*
T_1—*1600-kc. air-tuned i.f. transformer. (Sickles 8084. The grid lead, which is tapped down on the coil in the transformer as it comes from the manufacturer, must be moved to the stator plates of the grid tuning condenser before the transformer is used.)*
T_2, (L_4, C_{24}, R_{14}, C_8)—*1600-kc. b.f.o. unit (Sickles 6631).*
Ch—*500-henry audio impedance (Thordarson T-3736).*

is found that too much oscillator voltage reaches the second detector, the voltage to the plate of the b.f.o. can be reduced, and if too little oscillator voltage is being fed to the detector the coupling can be increased by draping a piece of insulated wire somewhere between the two circuits. The b.f.o. is made to turn off, for 'phone reception, by bending over one corner of the rotor plate of C_5, which shorts with the stator plate in the extreme position.



BOTTOM VIEW OF THE RECEIVER

A flexible shaft is used to turn the audio volume control at the rear of the set. Any stray coupling is avoided by thus mounting the audio volume control near the audio tube. The r.f. choke fastened to the back of the chassis is used to make the second detector regenerative. The switch near the drum dial turns off the plate voltage.

CHASSIS CONSTRUCTION

To facilitate home construction, the shielding was reduced to a minimum. It was decided that the first detector was the portion of the set that required shielding, if any was to be used, and so it was housed in a separate box, 4¾" x 6¼" x 4⅜" high, with a removable lid for changing coils. The chassis itself was made by bending a 9½" x 16¼" piece of 3/32" aluminum into a shallow "U" with 2⅛" sides and fastening on a rear strip and the ⅛" x 6½" x 13" panel with ¼" square brass rod. The photographs show the construction better than any words. Care was taken to make the chassis rigid, to insure stability. After all the holes have been drilled, the chassis and panel may be given a dull finish by soaking them in a lye solution for about fifteen minutes.

We ran into a condition in this receiver that might easily have been avoided. The completed receiver showed a tendency, especially on the higher-frequency bands, to "jump" from signal to signal instead of tuning smoothly. The grounded rotor-shaft of the oscillator tuning condenser was connected directly to the drum dial, and for some time we refused to believe that the dial was responsible for the "jumping." However, after everything else had been tried, we finally isolated the rotor from the dial by means of an insulated coupling, and our troubles disappeared. The erratic behavior had of course been caused by the several variable ground paths shunting the heavy supporting pillars of the tuning condensers. As the dial was rotated, these shunt paths varied and affected the frequency just enough to make things awkward. This has been pointed out several other times, but it had always sounded like so much "hokum." We know better now, and therefore recommend that any high-frequency oscillator tuning condenser be grounded at only one or two points and not shunted by the dial to ground.

LINING UP

Actually lining up the receiver takes only a short while. If a modulated oscillator is available, set it at around 1600 kc. (the exact frequency is unimportant) and connect its output to the grid of the 6L7 mixer. Then tune the i.f. transformer until the signal is the loudest. The b.f.o. condenser (on the side of the chassis) is set at half scale and the trimming condenser in the shield can is adjusted until a beat is obtained between the b.f.o. and the 1600-kc. signal from the signal generator. If no signal generator is available, set the second-detector regeneration control to the point where the detector oscillates and then adjust the b.f.o. until a beat is heard. The primary tuning of the i.f. transformer is next adjusted to the point where the regeneration control must be advanced the farthest to maintain oscillation. The primary will then be in tune with the secondary. If later it is found that the i.f. frequency selected falls on some broadcast harmonic or other unwanted signal, a slight readjustment will be necessary.

Adjustment and trimming of the coils is relatively simple. With a mixer and oscillator coil wound according to the table and placed in the receiver, set the tuning dial at the low-frequency end of its scale and tune around with the oscillator band-set condenser C_4 until a familiar marker or amateur signal at the low-frequency end of the particular band is heard. This adjustment should be with C_4 set at about ⅔ full capacity. Tune to the other end of the band to check for the bandspread of the oscillator. If the band doesn't occupy enough space on the dial, move the tap that goes to the tuning condenser C_3 *down* on the coil. If there is too much bandspread, move the tap *up* on the coil.

To make the mixer circuit track with the os-

A TOP VIEW OF THE RECEIVER

The high-frequency oscillator tuning condenser, in the center foreground, is ganged to the mixer circuit in the shield compartment. The i.f. transformer is directly in back of the mixer tube, and the grid leak and condenser are mounted directly on the grid lead to the second detector. The audio coupling choke and audio amplifier tube are to the left of the second detector. The b.f.o. unit and tube are directly in back of the drum dial.

The oscillator tuning condenser is supported above the chassis by two brass posts. Since the photograph was taken, the oscillator tuning condenser has been isolated from the dial by an insulated coupling, for reasons described in the text.

cillator, first tune in a signal at the high-frequency end of the band and peak the signal with the mixer band-set condenser C_2. Then tune in a signal at the low-frequency end of the band and see whether C_2 has to be increased or decreased to peak the signal. If the capacity has to be increased at the low-frequency end of the band the tuning tap should be moved *up* on the coil. If the capacity has to be decreased to peak the signal, the tap should be moved *down*. The adjustments should be not more than a quarter-turn at a time on the 14- and 28-Mc. ranges, but can be half-turns at the other frequencies. The tracking can be made as complete as one cares to go—it is simply a matter of patience. The total number of turns is right if C_2 resonates at about half-scale.

Adjustment of the cathode tap on the mixer coil comes next. It is desirable to have the cathode tap and the antenna coil so proportioned that the mixer goes into oscillation with the regeneration control set at about ⅔ scale. If the mixer goes into oscillation too soon, i.e., with the regeneration control set at something much less than ⅔ scale, the cathode tap should be made lower on the coil. The point at which oscillation takes place can also be varied by loosening the antenna coupling, either by reducing the number of turns in L_2 or by moving it farther away from L_1. All antenna-coil adjustments should be made with the antenna connected to the receiver.

When the "front end" of the receiver is working smoothly it may be worthwhile to experiment a little with the second-detector cathode condenser C_{12}. If oscillation of the second detector takes place at something less than ⅔ setting of the regeneration control, C_{12} should be made slightly smaller. It will be found that the two regeneration controls interlock slightly when both detectors are being run too close to the oscillating point, but this can be avoided by running the mixer in a slightly less regenerative condition.

NOTES ON OPERATION

In operation, the second detector is run in a regenerative condition but *not* oscillating. The b.f.o. is not tuned exactly to the same frequency as the regenerative second detector, but about 1000 cycles to either side. When this is done, a "single-signal" effect is noticed, i.e., the signal on one side of zero beat will be louder than on the other side. This condition is only achieved when the second detector is almost oscillating, and proves very useful in separating two signals quite close together. Although the single-signal effect obtained in this receiver does not approach that which results from the use of a crystal filter or regenerative 450-kc. amplifier, it does result in an S7 signal on one side of zero beat being reduced to an S4 signal on the other side. A little experimenting with the adjustment will make the operator familiar with the process of adjusting for maximum single-signal effect. Incidentally, it will be noticed that more

(Continued on page 106)

COIL TABLE

Band	L_1 Total Turns and Wire Size	L_1 Length of Winding	L_1 Cathode Tap *	L_1 B.S. Tap *	L_2 Total Turns and Wire Size	L_3 Total Turns and Wire Size	L_3 Length of Winding	L_3 Cathode Tap *	L_3 B.S. Tap *
3.5 Mc.	39 No. 24 d.s.c.	1 1/16"	1/8	36	4 No. 24 d.s.c. closewound	15 1/2 No. 20 enam.	1 3/16"	5	14
7	26 1/2 No. 20 enam.	1 3/16"	1/8	8	4 No. 32 d.s.c. "	14 1/2 No. 20 "	1 1/4"	5	12
14	12 1/2 No. 18 "	1 5/16"	2/8	3 1/2	2 No. 24 d.s.c. "	6 1/2 No. 18 "	1 1/4"	2	3 3/4
28	5 1/2 No. 18 "	3/4"	1/8	2	3 No. 32 d.s.c. "	2 No. 18 "	1"	7/8	1 3/4

All coils wound on 1½" diam. Hammarlund forms. L_1 and L_2 wound next to each other except on 7 Mc. where spacing between L_2 and L_3 is ¼". All coils except 3.5-Mc. L_2 are spacewound to occupy winding length given.

* Tap turns counted from grounded end of coil.

What the League Is Doing

League Activities, Washington Notes, Board Actions—For Your Information

Examination Schedule

The F.C.C. announces its schedule of amateur examinations for 1938. Consult the following list when you need to know when and where examinations will be held. Where exact dates or places are not shown, information may be obtained, as the date approaches, from the Inspector-in-Charge of the district. It should be noted that no examinations are given on national holidays or state holidays. All examinations begin promptly at 9:00 A.M., local time except for New Orleans and Honolulu, where they begin at 8:30 A.M.

DISTRICT NO. 1

Boston, Mass., Customhouse, 7th floor, every week day except Thursday.

DISTRICT NO. 2

New York City, 1024 Federal Bldg., 641 Washington St., Tuesdays, Thursdays and Saturdays.
Schenectady, N. Y., sometime in March, June, September and December.

DISTRICT NO. 3

Philadelphia, Pa., Room 1200, Customhouse, 2nd and Chestnut Sts., every Wednesday.

DISTRICT NO. 4

Baltimore, Md., Ft. McHenry, Wednesdays and Saturdays.

DISTRICT NO. 5

Norfolk, Va., Room 402, New P. O. Bldg., every Friday.
Winston-Salem, N. C., February 5th, May 7th, August 6th and November 5th.

DISTRICT NO. 6

Atlanta, Ga., 411 Federal Annex, Tuesdays and Fridays.
Nashville, Tenn., February 18th, May 20th, August 19th and November 18th.
Savannah, Ga., 208 Post Office Bldg., *Class A only, for time being;* examinations given at convenience of the inspector by arrangement with the office.

DISTRICT NO. 7

Miami, Fla., Room 312, Federal Bldg., each Monday and Friday, by appointment.
Jacksonville, Fla., June 4th and November 5th.
Tampa, Fla., 201 Stovalls Professional Bldg., *Class A only, for time being;* examinations given at convenience of the inspector by arrangement with the office.

DISTRICT NO. 8

New Orleans, La., 326 Customhouse, every Monday.
Little Rock, Ark., March 22nd and September 13th.

DISTRICT NO. 9

Galveston, Tex., Room 404, Federal Bldg., Wednesdays and Saturdays.

DISTRICT NO. 10

Dallas, Tex., 302 U. S. Terminal Annex Bldg., every Tuesday.
Oklahoma City, Okla., February 19th, May 21st, August 20th and November 19th.
San Antonio, Tex., March 12th, June 11th, September 10th and December 10th.
Albuquerque, N. M., April 30th and October 22nd.

DISTRICT NO. 11

Los Angeles, Calif., 1105 Rives-Strong Bldg., Mondays and Saturdays.
Phoenix, Ariz., two days in April and two days in October.
San Diego, Calif., 503 New California Bldg., *Class A only, for time being;* examinations given at convenience of the inspector by arrangement with the office.

DISTRICT NO. 12

San Francisco, Calif., 328 Customhouse, Class B, Mondays only; Class A, daily.

DISTRICT NO. 13

Portland, Oregon, 207 New U. S. Courthouse, every Friday.
Boise, Idaho, sometime in April and October.

DISTRICT NO. 14

Seattle, Wash., 808 Federal Office Bldg., every Friday.
Butte, Mont., sometime in May and November.
Spokane, Wash., sometime in May and November.
Juneau, Alaska, P. O. Box 2719, *Class A only, for time being,* examinations given at convenience of the inspector by arrangement with the office.

DISTRICT NO. 15

Denver, Colo., 504 Customhouse, first and third Saturday of each month.
Salt Lake City, Utah, sometime in March and September.
Billings, Mont., sometime in April and October.

DISTRICT NO. 16

St. Paul, Minn., 927 Main Post Office Bldg., first and third Saturdays of each month, and by appointment.
Bismarck, N. D.; dates can be secured from the Inspector-in-Charge at St. Paul.

DISTRICT NO. 17

Kansas City, Mo., 609 Pickwick Bldg., 903 McGee St., first and third Friday and Saturday of each month, and by appointment.
Des Moines, Ia., April 8th and 9th, July 8th and 9th and October 14th and 15th.
St. Louis, Mo., May 13th and 14th, August 12th and 13th and November 11th and 12th.

DISTRICT NO. 18

Chicago, Ill., 246 U. S. Courthouse Bldg., every Saturday.

DISTRICT NO. 19

Detroit, Mich., 1025 Federal Bldg., every Saturday.
Cincinnati, Ohio, sometime in May, August and November.
Columbus, Ohio, sometime in March, June, September and December.
Cleveland, Ohio, sometime in April, July and October.

DISTRICT NO. 20

Buffalo, N. Y., 514 Federal Bldg., first Friday of each month and by appointment. If the first Friday falls on a holiday, the examinations will be given on the following Friday.
Pittsburgh, Pa., sometime in March, June, September and December.

DISTRICT NO. 21

Honolulu, T. H., Aloha Tower, Mondays and Saturdays.
Hilo, T. H., July 22nd.
Wailuku, Maui, T. H., July 20th.
Lanai City, Lanai, T. H., July 19th.
Kaunakakai, Molokai, T. H., July 18th.
Lihue, T. H., August 12th.

DISTRICT NO. 22

San Juan, P. R., 303 Ochoa Bldg., *Class A only, for time being;* examinations given at convenience of the inspector by arrangement with the office.

HEADQUARTERS

Washington, D. C., F.C.C. offices, every Thursday; other days by appointment.

The Infinite Rejection Principle Applied to Image Attenuation

A New Method of Eliminating Images in Superhet Receivers

By Karl W. Miles and J. L. A. McLaughlin*

AN inherent peculiarity of the superheterodyne is its ability to respond simultaneously to signals of two different frequencies which are separated by *twice* the frequency of the i.f. amplifier. Where the oscillator, mixer and r.f. amplifier tuning condensers are ganged together, as is now accepted modern practice, and the oscillator is tuned i.f. frequency higher than the frequency of the desired signal, the undesired signal of the other response frequency, commonly referred to as the image, will be more or less attenuated because of the selective action of the tuned circuits between the antenna and mixer. The amount of this attenuation, in terms of voltage, is called the *image ratio*, and will depend on the shape of the selectivity curve of the input circuits. The i.f. amplifier selectivity will in no way affect this ratio.

Now at a frequency of, say, 1000 kc., the image ratio of a superheterodyne with an r.f. stage ahead of the mixer will be of the order of 10,000 or better. That is, the image signal will have to be 10,000 or more times as strong as the desired signal to give the same output. At 2000 kc. the ratio will be down to something like 1000 and at 7 Mc. to about 200. At 14 Mc. a ratio of about 50 is usual and at 30 Mc. a ratio of two or three is considered pretty fair.[1]

Now why does the image ratio become so poor at the higher frequencies? Simply because as the frequency goes up the percentage difference between the signal and image frequencies grows less; in other words, the image frequency is climbing nearer the nose of the resonance curve and approaching par with respect to the signal frequency. If we persist in our attempt to eradicate the image by means of purely selective devices at frequencies in the neighborhood of 30 Mc. and higher, we will find that progress is comparatively slow. We can go on adding preselection to the

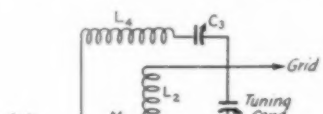


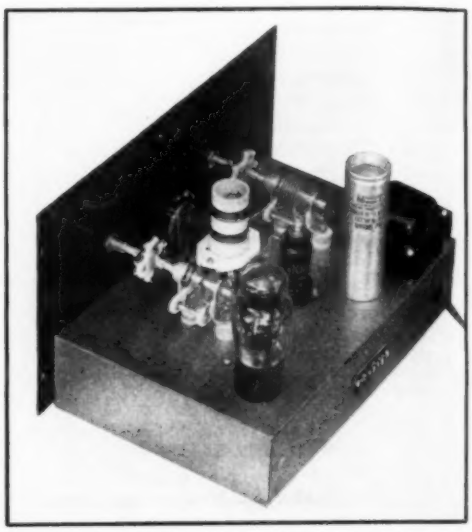
FIG. 1—THE IMAGE REJECTOR CIRCUIT

Values of the components labelled will depend upon the tuning system and other features of the receiver with which the rejector is used. Experimental values determined in one type of receiver are as follows:

C_3—*7 and 14 Mc.: 15-μμfd. variable; 28 Mc.: 10-μμfd. variable.*
L_1—*7 and 14 Mc.: 4½ turns No. 34 d.s.c., diameter ¾ inch. 28 Mc.: 2½ turns No. 34 d.s.c., diameter ¾ inch.*
L_2—*7 and 14 Mc.: 10½ turns No. 22 d.s.c., diameter ¾ inch. 28 Mc.: 2 turns No. 20 d.s.c., diameter ¾ inch.*
L_3—*7 and 14 Mc.: 3 turns No. 22 d.s.c., diameter ¾ inch. 28 Mc.: 2 turns No. 20 d.s.c., diameter ¾ inch.*
L_4—*7 and 14 Mc.: 15 turns No. 34 d.s.c., diameter ¾ inch. 28 Mc.: 8 turns No. 34 d.s.c., diameter ¾ inch.*
R—*1000-ohm rheostat.*

These will serve as a basis for experimental work with a particular set-up. The main tuning condenser is assumed to cover 7 and 14 Mc. at opposite ends of its scale.

* The Hallicrafters, Inc., 2611 Indiana Ave., Chicago, Ill.



AN INEXPENSIVE AND EASILY-BUILT PRESELECTOR WITH IMAGE REJECTION

The range covered is 9 to 16 Mc. The nearer variable condenser is the image rejection control; that on the far side the regular tuning condenser. The power-factor correction resistor is mounted on the panel.

[1] The image ratio figures are based on an i.f. of the order of 465 kc. and the use of ordinary tubes and circuits at signal frequency. At the higher frequencies, some improvement in performance can be secured by using acorn tubes because of their lesser loading effect on the tuned circuits.—Editor.

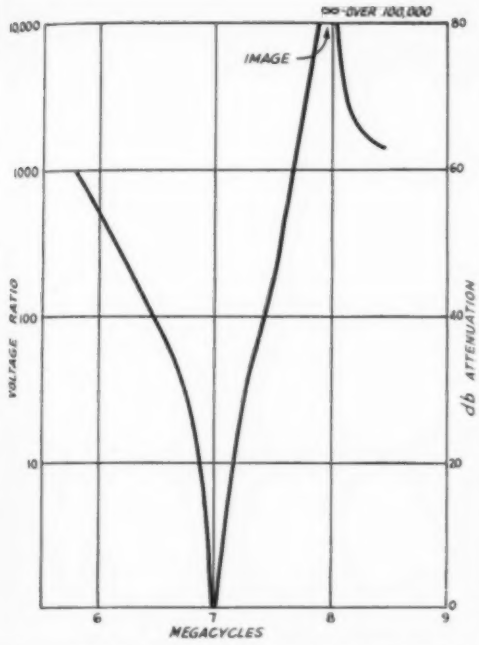


FIG. 2—SELECTIVITY CURVE OF R.F. END WITH RECEIVER TUNED TO 7 MC. AND IMAGE REJECTOR ADJUSTED TO 7.93 MC.

The i.f. selectivity of the receiver is not included in this curve nor in the curves of Figs. 3 and 4.

point where the number of stages becomes impracticable to handle and still not duplicate the performance given by a few stages at the lower frequencies.

Some other means of improving image ratios at the higher frequencies obviously is needed. One method which shows promise is a variation of the i.f. infinite rejection system recently described in *QST* by the present authors.[2] Similar coupling devices can be made infinitely selective in rejecting the image frequencies.

Fig. 1 shows the fundamental circuit. As in the i.f. system, we have a primary L_1 which couples to L_2 through the mutual M and capacity C_3. L_2 and L_3 together form the signal-frequency tuning coil; L_1 and L_4 the image-rejection circuit inductance. The reason for using L_4 will be explained later on. The coupling between the antenna (or interstage) input and the grid circuit is the product of M and C_3. For the signal frequency the circuit behaves very much the same as a straight inductively-coupled stage with small capacity coupling at the high-potential side. But for the image frequency, the voltage through C_3 equals the voltage induced in the mutual M and, being of opposite sign, cancels out. To make the null infinite, the power-factor corrector R is necessary. With proper power-factor correction, no coupling exists at the image frequency. In practice, because of stray coupling or through direct pickup in some part of the circuit beyond the rejector stage, some image signal may leak through, but with careful design the signal-to-image ratio can be made better than 100,000 at frequencies as high as 36 Mc. This is the highest frequency so far attempted.

Experimental work has been done on single-stage application and on two standard receivers. In one instance, in which the rejector system was inserted in the mixer circuit of a receiver having no r.f. stage, image ratios of over 2000 were achieved at frequencies as high as 16 Mc. Stray couplings by-passing the rejector circuit prevented greater rejection. This gives some idea of the effectiveness of the rejector circuit, however, because an image ratio of 2000 at 16 Mc. is higher than can be obtained in a good receiver with two or three stages of preselection ahead of the mixer.

Figs. 2, 3 and 4 are curves showing the front-end performance of a receiver having one r.f. stage ahead of the mixer, the rejection being applied to the r.f. grid circuit. The i.f. selectivity of the receiver is not included in these curves. In each case the rejector is adjusted to signal frequency plus twice the i.f., the signal circuit being tuned to resonate at 7 Mc. in Fig. 2, 14 Mc. in Fig. 3 and 30 Mc. in Fig. 4. The power-factor correction resistor, R, is in all cases adjusted for maximum attenuation of the image. The plots extend to

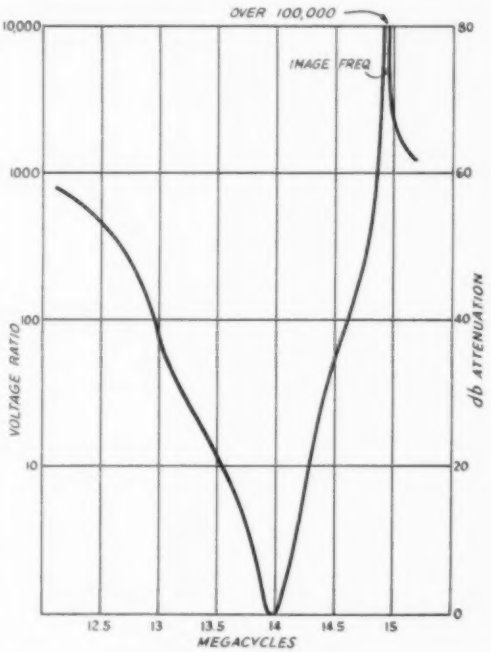


FIG. 3—RECEIVER TUNED TO 14 MC. AND IMAGE REJECTOR ADJUSTED TO 14.93 MC.

[2] Miles and McLaughlin, "A New I.F. Amplifier System with Infinite Off-Frequency Rejection," *QST*, November, 1937.

BELOW CHASSIS VIEW OF THE PRESELECTOR

The variable resistor is the gain control. The output transformer, L_4L_5, is mounted close to the tube socket.

only a ratio of 10,000, or 80 db; the actual signal-to-image ratio is over 100,000 in all cases.

AN IMAGE-REJECTING PRESELECTOR

Because of the worth-while improvement in the complete wiping out of image frequencies that this radically different coupling circuit offers, some practical information should be included in this article. So that interested amateurs and experimenters may be able to adapt such a device to their present equipment, we have built up a simple r.f. stage which may be connected to any receiver. The parts are few and the construction is simple. The frequency range is from 9 to about 16 Mc. and the unit is intended for use on the 14-Mc. band. This is the range in which the average image starts to become bothersome. The circuit diagram and constants are given in Fig. 5.

To get the rejector circuit working properly pick out some band where you know there are images, for example, the region around 13 Mc. Tune over this band until you pick up the image of some 14-Mc. amateur 'phone, and peak up the circuits by means of C_2 and C_4. Then slowly turn the rejector condenser, C_3, until a spot is found where the 'phone drops out or is greatly attenuated. Finally, adjust resistor R_2 for maximum attenuation. When you are sure the system is working properly on this frequency, the receiver and preselector can be tuned to the 14-Mc. band and the rejector adjusted to wipe out bad images in this range.

If no rejection point can be found, it may be because L_1 is reversed, C_3 may be too large, R_2 may be too large or too small, or there may be no images at the frequency to which the preselector and receiver are tuned. If a rejection point is found and the image is still audible, see if the image can be picked up with the antenna disconnected. If so, the image signal is getting in at some point past the rejector circuit and shielding should be tried to reduce this pickup.

We should like to give coil information for use on the 30-Mc. band because this is where the rejector is certainly most needed. However, it is difficult to give constants which would have much practical value at these frequencies. The coils have so few turns that the wires leading to them are apt to have as much inductance as the coils themselves, and since C_3 may become less than 1 $\mu\mu$fd., duplication therefore would become quite difficult. Another reason for not doing so is that at this frequency the rejector preferably should be built into the receiver itself, so that maximum efficiency may be achieved and proper shielding employed to prevent the image signal from being picked up on the output side of the rejector circuit.

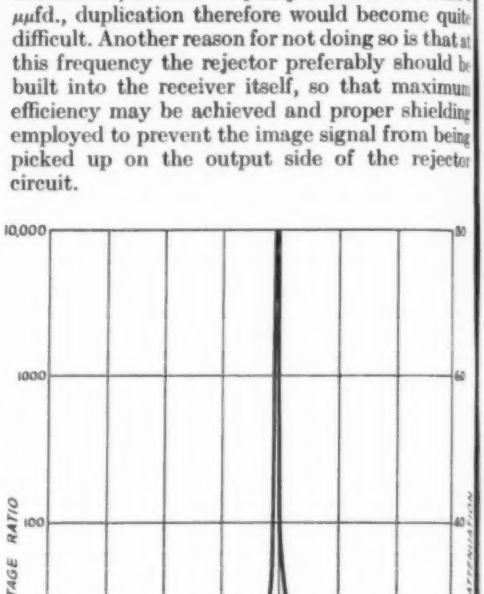


FIG. 4—RECEIVER TUNED TO 30 MC. AND IMAGE REJECTOR ADJUSTED TO 30.93 MC.

The incorrigible experimenter, we know, will wind coils for other ranges—perhaps with happy results. To him we offer this advice. Couple the plate of the r.f. stage to the input of the receiver with the shortest possible lead, and on the 30-Mc. range tune the plate circuit of this tube and couple to the receiver through a low-impedance line. It is important to build up the greatest gain possible at these frequencies. The image frequency is so close (in percentage) to that of the signal that with complete rejection of the image there may be appreciable loss of signal strength. At 30 Mc. the gain may drop to about one-tenth of what it was without rejection, so if the r.f. stage gain is kept high—and a gain of ten can be had at

these frequencies—the desired signal (with the rejector set to the image frequency) will be at about the same level at the receiver as it was before the selector-rejector stage was added. A great deal of this loss can be overcome by careful circuit construction in attaining maximum Q in the tuned circuit, together with the optimum degree of antenna coupling. For example, in a production model of the receiver in which this system is used, there is only a 20 per cent loss in gain with the rejector circuit set for maximum attenuation; with an image ratio of 2000 there is no perceptible loss of desired signal.

At 14 to 30 Mc. the rejector condenser capacity (C_3) ranges from a fraction of a $\mu\mu$fd. to but a few $\mu\mu$fd. and resistor R is from 250 to 1500 ohms. The higher the frequency the lower the resistance needed. Some interaction between the rejector control and the selector control may be experienced; in a single stage this is of little consequence, but when built into a receiver with all the tuning controls ganged together may be quite serious. To overcome this defect L_4 (Fig. 1) is employed. The use of this coil increases the voltage in the rejector circuit and reduces the effect of C_3 on the signal-tuning circuit. When L_4 is used C_3 becomes considerably smaller.

Although the value of resistance used for power factor correction must be carefully adjusted for maximum rejection, in practice it has been found that a fixed resistor of optimum value for the band over which the circuit is to work will permit dispensing with one control without undue sacrifice of image attenuation. Provided the proper value of fixed resistance is used, highly effective image suppression can be obtained—not the full capabilities of the system, but still capable of relegating practically all image signals to the background. The fixed resistor could be incorporated in the plug-in coils (or switched with the coils in a band-switching receiver) after the optimum value for each range has first been obtained experimentally by the use of a variable resistor.

To give practical information on coil design and the incorporation of this circuit into existing manufactured receivers is out of the question. No two manufacturers' receivers would require the same treatment and coil design. Also, without the proper laboratory equipment and knowledge the performance of an otherwise perfectly good receiver might be greatly impaired. Third, most manufacturers void their guarantee if any tinkering is done with "innards" of their receivers. There is no reason, however, why the circuit could not be tried out on home-built jobs.

The majority of curves and coil information contained in this article are taken from the work done on the application of the infinite image rejector to a standard "Challenger" type receiver. A rejector was inserted in the r.f. stage and was made to operate over the range from 7 to 30 Mc. The gain of the receiver with and without the rejector in operation is the same for all frequencies up to 20 Mc. Beyond 20 a slight loss of signal is

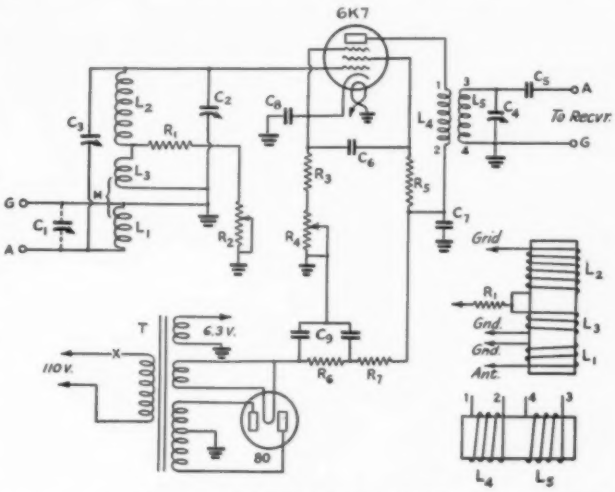


FIG. 5—CIRCUIT DIAGRAM OF IMAGE-REJECTING PRESELECTOR FOR 9- TO 16-MC. RANGE

L_1—10 turns No. 34 s.e.
L_2—5 turns No. 20.
L_3—3 turns No. 20.
L_1, L_2 and L_3 on same form, diameter 1⅛ inch (Hammarlund); L_2 and L_3 spaced ⅞ inch, L_1 and L_3 closely coupled. Note winding direction in drawing.
L_4—15 turns No. 36 s.e.
L_5—5 turns No. 20.
L_4 and L_5 on same form, diameter ¾ inch, ⅛ inch between coils.
C_1—100-$\mu\mu$fd. variable (optional).
C_2—100-$\mu\mu$fd. variable, input tuning (Hammarlund).
C_3—20-$\mu\mu$fd. variable, image rejection (Hammarlund).
C_4—150-$\mu\mu$fd. padder, output tuning.
C_5—200-$\mu\mu$fd. fixed.
C_6, C_7, C_8—0.05-μfd. paper.
C_9—Dual 8-μfd. electrolytic.
R_1—600 ohms, ½ watt.
R_2—100-ohm variable (power factor correction).
R_3—500 ohms, ½ watt.
R_4—10,000-ohm variable (gain control).
R_5—100,000 ohms, ½ watt.
R_6, R_7—20,000 ohms, 1 watt.
T—Power transformer to deliver 250 volts d.c., with 6.3-volt filament winding (General No. 1657).

observed when the rejector is adjusted to the image frequency.

The design of an r.f. amplifier is generally a compromise between gain and image rejection. In the conventional cascaded selective coupling circuits gain and image ratio are inversely related because of the broadening of the resonance curves of the individual circuits when the coupling is adjusted for maximum gain. Since in this system the two functions are distinct and separate, the gain of the r.f. stage can be made considerably

(Continued on page 98)

New Approach to Amateur Transmitter Design

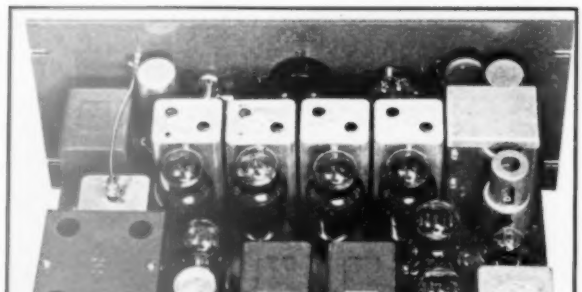
By James Millen,* W1HRX

THE r.f. exciter in a transmitter can have high "survival value" if it is properly designed. Final stages, buffers, and modulators may come and go (and they usually do, in most amateur stations), but the exciter, like the receiver, should be designed carefully and built as a long-time investment. Such an exciter should be capable of operating at any predetermined frequency in the amateur bands, and the operation of selecting a frequency should be rapid and convenient. If these specifications are completely filled, such a unit can become part of the permanent equipment of the shack to the same extent that a good receiver does.

In the 'phone transmitter, the same considerations apply to the audio preamplifier. If it has an output of about 15 watts, it will serve very nicely either as a complete voice end for grid or suppressor modulation, or as a driver for a Class-B stage. A pair of 838's (these tubes are particularly convenient because they need no fixed bias) require only 7.5 watts of driving power for 260 watts output; where more power is needed a biased tube such as the 806 will supply 660 watts (per pair) with 10 watts of driving power. So 15 watts of driving power is ample.[1] The other important requirement of the preamplifier is voltage gain. The amplifier will be satisfactory if it delivers full output with an input of not more than 0.005 volts at the grid of the first tube.

For some time it has been our feeling that it would be a perfectly swell thing if we could have some kind of gadget containing a solution to all of the headaches normally encountered in the construction of a transmitter. The bulk of the so-called headaches are pretty well confined to the speech amplifier and the exciter, consequently if these two could be combined once and for all in one compact cabinet, along with all the necessary power supplies, switches, and accessories, the construction or reconstruction of the rest of the transmitter would be just plain fun.

With this in mind, we took a chassis, cabinet and other parts normally used to make an NC-100 receiver, and tried to build such a device. While from a circuit point of view the results were reasonably satisfactory, the unit was somewhat of a monstrosity mechanically. Certainly it seemed foolish to shift a large catacomb back and forth for band changing when most of the compartments were empty and the contacts therein were used simply for switching purposes.



A COMBINATION R.F. AND AUDIO EXCITER

R.f. output on four bands with push-button control, as well as a speech-amplifier and driver for a Class-B modulator.

About this time we became very much intrigued by a type of switch used in the telephones now furnished with the Western Electric automatic exchanges. One of our engineering associates, W1HSV, designed a very compact switch using the same principles which would do everything that the shifting catacomb did, and do it much more quickly and conveniently. Around this switch developed the circuit and mechanical arrangement which is the subject of the present discussion, and which is illustrated in the accompanying diagram and photographs. This particular model is intended for the man who wants especially to operate in the four 'phone sub-bands in the 3.5-, 14-, 28- and 56-Mc. amateur bands. Any one of the four can be selected by pushing in the appropriate button. With one possible exception noted below, all tank circuits are pretuned, so that no additional operations are required to get "on frequency."

THE EXCITER CIRCUIT

Basically, the exciter circuit is conventional enough. It employs a crystal-controlled 6L6G

* Malden, Mass.

[1] An excess of driver power always is desirable, especially when the driver works into tubes requiring fixed bias, because better voltage regulation is obtained than when the driver is loaded to its maximum capabilities. The driving power figures given in the tube manuals are approximate, while output figures are tube output and do not include losses in coupling devices.—EDITOR.

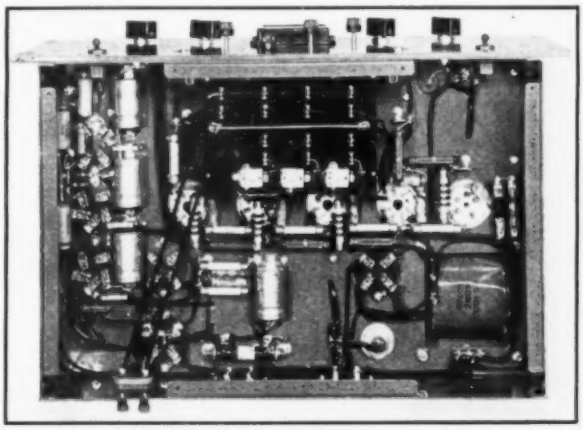
oscillator operating at 3.5 Mc., followed by three frequency-multiplier stages, also employing 6L6G's. Its unusual features are in the details. For instance, single, multiple, or variable-frequency type crystal holders can be used, since adequate space has been provided around the 5-prong crystal socket, and provision has been made for controlling the crystal switch or movable top plate from the front panel by means of a flexible shaft. The use of either of these versatile crystal systems makes it possible to select a convenient operating frequency within the band simply by turning a knob, a convenience whose importance we do not have to enlarge upon here. In most cases the oscillator and doubler tanks are broad enough to require no retuning, but in the special case where crystals of widely different frequencies are chosen for the multiple holder a slight adjustment of the oscillator tank is desirable. For this purpose a tuning control and a meter are provided on the panel. This control also permits securing the best adjustment for any particular crystal and for best keying conditions when using the outfit on c.w. A jack is provided on the front panel for plugging in the key; it is connected in the cathode circuit of the oscillator.

As will be seen from the wiring diagram, Fig. 1, and the bottom view of the chassis, each section of the switch has a small mica trimming condenser mounted on it. The condensers serve as compensators and are automatically cut in or out of the circuit by the switch. When shifting from the 28-Mc. to the 14-Mc. band, for instance, the 28-Mc. doubling tube is cut out of the circuit. To avoid detuning the 14-mc. tank, the small trimming condenser is switched across it.

One of the fundamental problems in exciter design is that of maintaining uniform output on different bands. As a matter of fact, it is usually desirable so to arrange the circuits that output increases with frequency, since the larger tubes to which the exciter is connected ordinarily will require increasing driver power. With tubes of the high-mu triode type (53's, etc.) it is possible to maintain nearly constant output but the desired increase is not available, particularly at 14 and 28 megacycles. The 6L6G's, on the other hand, have the ideal characteristic of requiring extremely low excitation for full output, and it is possible to quadruple with practically no loss in power and to obtain an actual increase when doubling, except at 56 Mc. The line-up of the 'phone-band model will, therefore, do everything that is asked of it, its output being essentially the same at 3.5 and 14 Mc., with a definite increase at 28 and 56 Mc. The output is sufficient to drive all of the common pentodes and beam tubes used in amateur work, as well as the low- and medium-power triodes. Large triodes will require additional power, but since the driving tube would require high voltage, it seemed more logical to locate it near the final, rather than to attempt to incorporate it in the exciter.

THE METER CIRCUIT

As an aid in tuning the oscillator and doubler tanks, a meter and selector switch are provided on the front panel. A voltmeter with a range of 200-300 volts is used for this purpose, rather than the customary plate milliammeter. Reference to the wiring diagram will show that this meter is switched across the grid bias resistor of the following stage and consequently measures grid voltage. This is a convenient measure of the excitation, since the d.c. voltage being measured is produced by grid rectification of the exciting signal. In fact, the combination of grid, cathode, grid resistor and meter can be regarded as a conventional rectifier-type a.c. voltmeter. In use, the tuning is adjusted for *maximum* swing of the meter, not minimum swing as in the case of the milliammeter in the plate circuit.



BOTTOM VIEW OF THE EXCITER

The works of the cam-operated push-switch are behind the bakelite panel in the upper foreground.

THE AUDIO CIRCUIT

To get sufficiently high gain to handle the now popular crystal microphone and still secure an output of the order of 10 watts or so to drive the average Class-B modulators, it was necessary to use four stages. These consist of a 6C6 pentode resistance coupled to a 76, which in turn is resistance-coupled to the 76 driver for the push-pull 2A3's. It is necessary, of course, to filter each plate circuit separately, and this filtering must be effective in eliminating r.f. as well as in preventing audio feedback.

It would hardly be worth while to describe in detail the experimental work necessary to obtain completely stable performance with both r.f. and audio channels in operation at the same time, since any such discussion would necessarily apply only to this particular unit and would be of little value to an amateur attempting to construct a similar piece of equipment with a slightly different layout. There are, however, a few points which it might be well to mention. The treatment of the circuit elements associated with the 6C6 tube requires special care; all by-pass condensers and resistors must be grounded at the correct point (found experimentally) on the chassis and all elements, including the cathode resistor and by-pass condenser, must be mounted in a tightly-fitting metal shield. Even the grounding of this shield is rather fussy, and it should preferably be isolated from the front panel. In using any high-

(Continued on page 118)

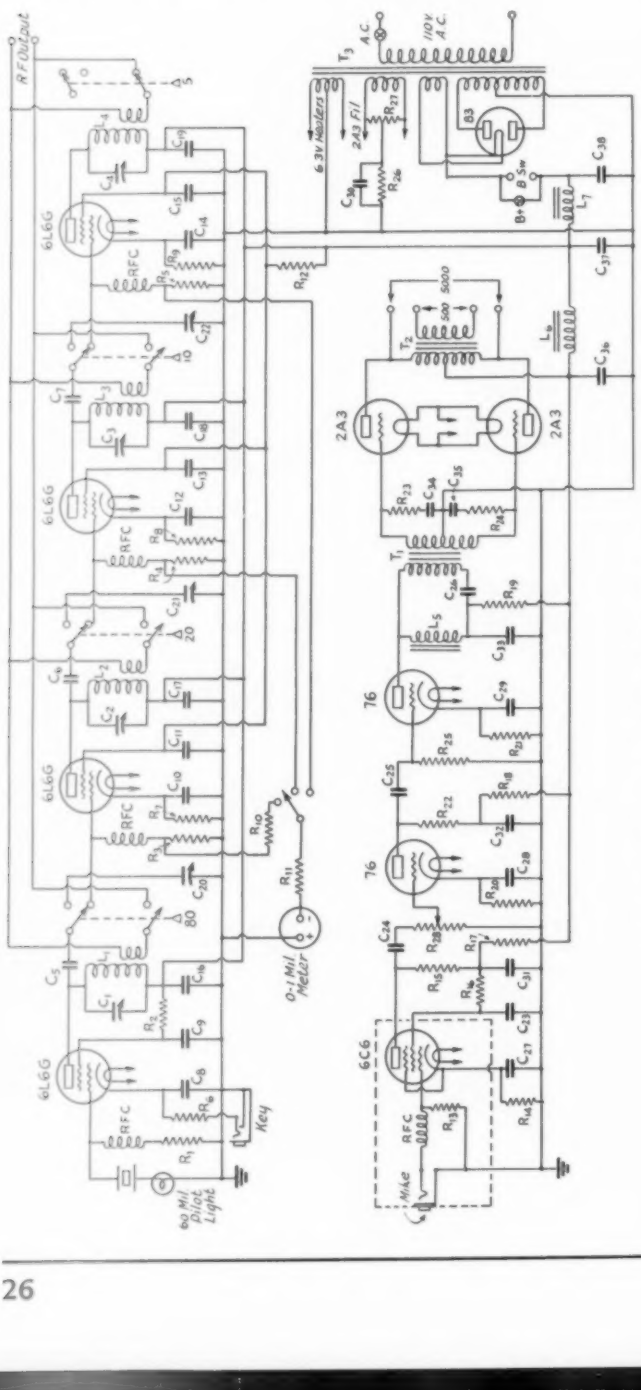


FIG. 1—CIRCUIT DIAGRAM OF THE COMBINATION EXCITER

L_1—32 turns No. 28, on 1" form, 60 turns per inch (3.5 Mc.).
L_2—8 turns No. 24, on 1" form, 24 turns per inch (14 Mc.).
L_3—3¼ turns No. 24, on 1" form, 24 turns per inch (28 Mc.).
L_4—4 turns No. 24, on 9/16" form, 24 turns per inch (56 Mc.).
Links 2 turns in each case.
L_5—30-henry, 20-ma. choke.
L_6—10-henry, 80-ma. choke.
L_7—10-henry, 160-ma. choke.
R_1—20,000 ohms, 1-watt.
R_2—20,000 ohms, 10-watt.
R_3, R_4, R_5—20,000 ohms, 1-watt.
R_{10}—100,000 ohms, 1-watt.
R_{11}—200,000 ohms, 1-watt.
R_{12}—7500 ohms, 10-watt.
R_{13}—5 megohms, ½-watt.
R_{14}—1000 ohms, ½-watt.
R_{15}—250,000 ohms, ½-watt.
R_{16}—1 megohm, ½-watt.
R_{17}, R_{18}, R_{19}—20,000 ohms, ½-watt.
R_{20}, R_{21}—2500 ohms, ½-watt.
R_{22}—100,000 ohms, 1-watt.
R_{23}, R_{24}—100,000 ohms, ½-watt.
R_{25}—1 megohm, ½-watt.
R_{26}—750 ohms, 15-watt.
R_{27}—60-ohm c.t. resistor.
R_{28}—500,000-ohm volume control.
C_1, C_2, C_3, C_4—Double 25-μμfd. variables (in National FXT exciter tank assembly).
C_5, C_6, C_7—100 μμfd. mica.
C_8 to C_{15}, inc.—0.1 μfd., 400-volt paper.
C_{16} to C_{19}, inc.—0.001-μfd. mica.
C_{20}, C_{21}, C_{22}—30-μμfd. (National M-30).
C_{23} to C_{26}, inc.—0.25 μfd., 400-volt paper.
C_{27} to C_{30}, inc.—10-μfd. electrolytic, 50-volt.
C_{31}, C_{32}, C_{33}—8-μfd. electrolytic, 450-volt.
C_{34}, C_{35}—0.01-μfd. 400-volt paper.
C_{36}, C_{37}, C_{38}—4-μfd. oil-filled, 600-volt (Aerovox).
T_1—Interstage audio, 3:1, with c.t. secondary.
T_2—Class-AB output, push-pull 2A3's to 500-ohm line.
T_3—Power transformer, 400 volts, 250 ma., with fil. windings.
RFC—2.5-mh. chokes (National R-100).
Switch—Cam-operated, s.p.d.t. and s.p.s.t. (National ACS-4)

Compact Construction with High Power

A Complete 500-Watt C.W.-'Phone Transmitter of Small Dimensions

By T. M. Ferrill, Jr.,* W5CJB-1

THE transmitter herein described was built with two objects in view: First, to provide a completely self-contained transmitter of large output, so small that it could be crated and shipped conveniently, carried in a car or small truck in case of emergency, or installed in small living quarters; second, as an experiment to determine how practical in operation a transmitter built in this manner would be.

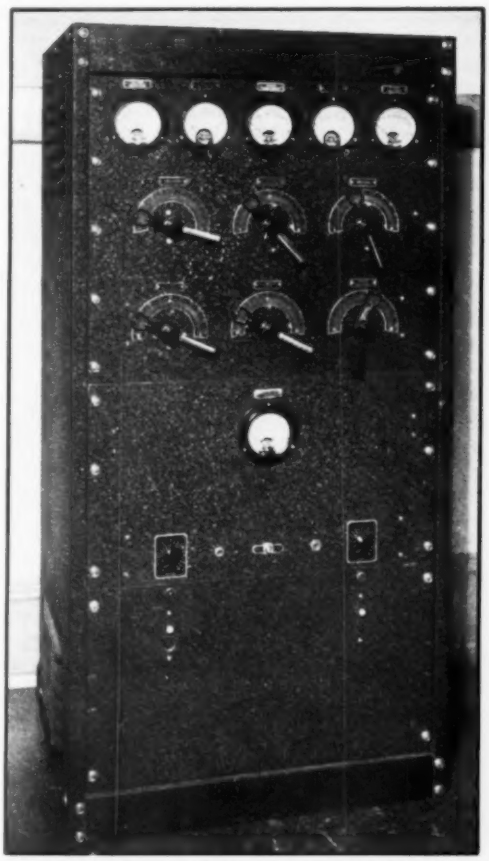
The advantages of compactness in transmitter design are obvious. Portability and convenience of operation are two of the major features; in fact, this transmitter is usually placed on the operating desk beside the receiver, where controls directly on the transmitter panels are within easy reach of the seated operator. Relays for switching power supplies, and separate speech amplifiers for convenient control of audio amplification, are thus eliminated. The disadvantages of extreme compactness remained to be found by actual use of the finished unit. Some guess as to the troubles to be expected was made, but their extent and the best methods of overcoming them provided more than sufficient incentive for the undertaking.

For the benefit of those who might be attracted by some of the features of this transmitter to duplicate it, it must be pointed out that the compact design necessitated the sacrifice of other desirable features ordinarily considered important. Furthermore, the composite nature of the transmitter required many hours of painstaking work to adapt commercially-available apparatus to fit into the very limited space. The plate tank tuning condenser of the final r.f. amplifier required eight alterations, each of which involved cutting metal. To install the insulators supporting the final amplifier tank coil, new pieces had to be substituted in the bases, decreasing the space required for the feed-through insulators below the chassis, and allowing mounting of the associated tuning condenser directly beneath the plate coil. Similar fitting was employed in the construction of the power supplies; indeed, the greater part of the work was made necessary by the attempt at extreme compactness. It was necessary to use the smallest number of amplifying stages consistent with good design practice in both the radio-frequency and audio-frequency equipment.

*Massachusetts Institute of Technology, Cambridge, Mass.

APPARATUS LAYOUT

The transmitter is divided into three units; radio frequency equipment, audio frequency equipment, and power supplies. The r.f. section consists of one rack-panel and chassis containing all the r.f. equipment, all meters except that indicating modulator plate current, and the filament transformer heating all filaments of r.f. tubes. The second unit, built likewise on one panel and chassis, contains all audio equipment, power supply for the speech amplifiers, filament transformer for the modulator tubes and in addition, one of



THE COMPLETE HALF-KILOWATT 'PHONE AND C.W. TRANSMITTER

Occupying a total volume of less than 7.5 cubic feet, the overall dimensions are 42 by 20.5 by 15 inches, everything included except microphone and key.

the high-voltage power transformers, which is connected to one pair of 866 tubes in the bottom unit. On the panel of the modulator unit are the gain controls and input jacks, the switch controlling the a.c. supply to the audio equipment, and the modulator plate milliammeter. The third unit consists of one power supply for oscillator plate and grid-bias on buffer and final amplifier, one supply for buffer and final amplifier plates, and one supply for the modulator tubes. This unit was built directly on the base of the cabinet. A separate panel was mounted on the front of the cabinet to hold power switches, overload relays, and pilot lights.

To provide adequate driving power for the final amplifier operating as a plate-modulated Class-C stage, it was necessary to use a crystal oscillator with high harmonic output and to realize high power gain in the buffer stage. At the time the transmitter was being designed, an RK23 tube was chosen for the oscillator, to be used as a Tri-tet at all times. One of the beam-power tubes of corresponding size would probably have been the choice for the oscillator, had these tubes been developed. Both RK20 (with proper circuit alterations) and T55 tubes have been used in the buffer stage, and either is perfectly satisfactory. An HF100 tube would also be a very suitable tube for this application, and one of the new beam tubes of the fifty-watt size would be admirable here. It was necessary to use conservatively rated tubes in this transmitter, and to operate them well within their ratings, since the cooling is none too effective at best. An HF300 tube was chosen for the final, after some experimentation with smaller tubes which ordinarily should handle the power which the HF300 takes. The smaller tubes were operated within their ratings but failed to withstand the strain.

CIRCUIT DETAILS

For the particular tube arrangement shown in Fig. 1 the most desirable method of coupling between stages would ordinarily be adjustable link coupling, with oscillator and buffer on one chassis and final amplifier on another. Here, space consideration dictated the use of either capacity coupling or inductive coupling with coils built in pairs. Both methods of coupling—capacity and inductive—have been used in this transmitter with almost equal results; the latter, however, gave slightly more efficient power transfer and helped to maintain balance of the tuned circuits, as would be expected.

The keying arrangement shown is used because of its simplicity and lack of undesirable keying characteristics. As the keyed circuit operates at a high negative potential with respect to the metal cabinet, a relay is provided to isolate the key. This method of keying is very suitable for break-in

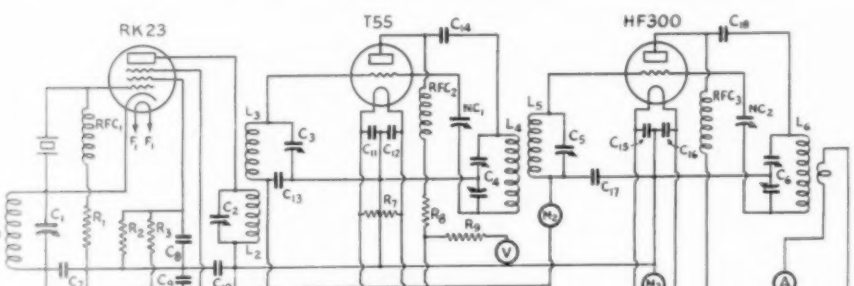


FIG. 1—THE RADIO-FREQUENCY SECTION

C_1—140 μμfd. (Cardwell ZU-140-AS).
C_2, C_3—150 μμfd., 0.07" spacing (Cardwell MT-150-GS).
C_4—210 μμfd. per section, 0.07" spacing (Cardwell XT-210-PD).
C_5—220 μμfd. 0.07" spacing (Cardwell XT-220-PS).
C_6—150 μμfd. per section, 0.17" spacing (Cardwell TJ-150-UD).
C_7—0.002-μfd. mica, 1000-volt.
C_8—0.006-μfd. mica, 600-volt.
C_9—0.01-μfd. mica, 600-volt.
C_{10}—0.01-μfd. mica, 1000-volt.
C_{11}, C_{12}, C_{13}—0.01-μfd. mica, 600-volt.
C_{14}—0.002-μfd. mica, 5000-volt.
C_{15}, C_{16}—0.01-μfd. mica, 600-volt.
C_{17}—0.002-μfd. mica, 1000-volt.
C_{18}—0.002-μfd. mica, 12,500-volt.
NC_1—2–6 μμfd. 6000-volt.
NC_2—5–14 μμfd., 8000-volt.
R_1—50,000 ohms, 2-watt.
R_2—12,500 ohms, 25-watt.
R_3—10,000 ohms, 25-watt.
R_4—10,000 ohms, 75-watt.
R_5—10,000 ohms, 40-watt.
R_6—6000 ohms, 75-watt.
R_7, R_{10}—100 ohms, center-tapped 10-watt.
R_8—4000 ohms, 200-watt.
R_9—Voltmeter multiplier.
RFC_1—2.5-mh. r.f. choke (National R100).
RFC_2, RFC_3—2.5-mh., 500-ma. r.f. choke (Hammarlund CH-500).
M_1—0–25 d.c. milliammeter.
M_2—0–200 d.c. milliammeter.
M_3—0–500 d.c. milliammeter.
A—0–5 r.f. ammeter.
V—0–2500 d.c. voltmeter.

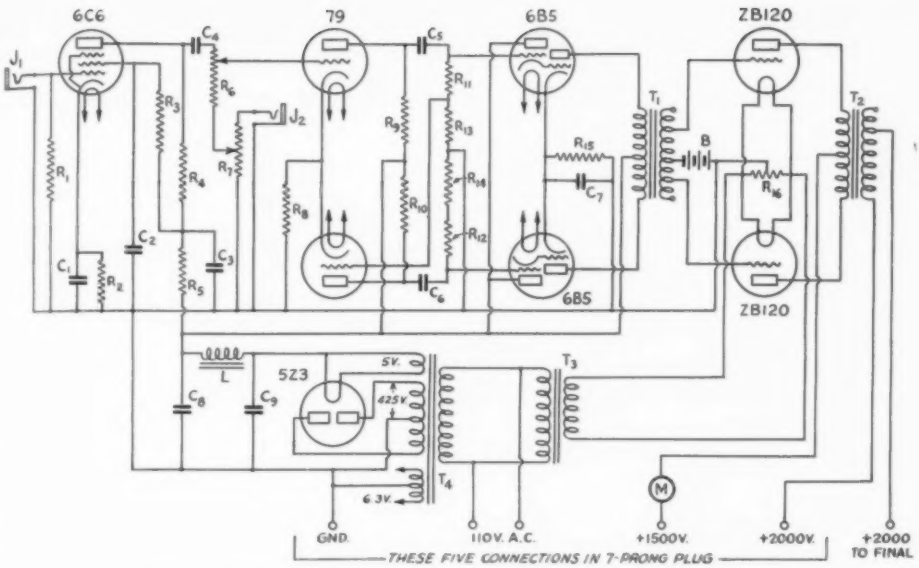


FIG. 2—WIRING DIAGRAM OF THE AUDIO-FREQUENCY SECTION

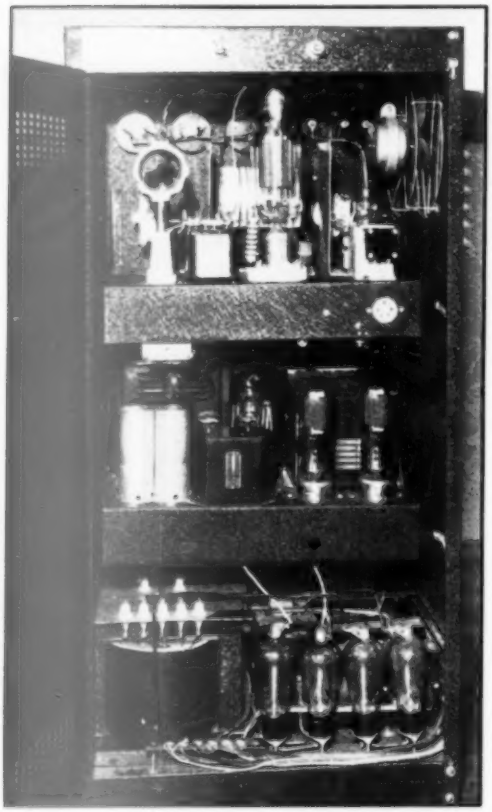
C_1—10-μfd. 25-volt electrolytic.
C_2, C_3—1-μfd. 600-volt paper.
C_4, C_5, C_6—0.01-μfd. mica, 600-volt.
C_7—10-μfd. 50-volt electrolytic.
C_8, C_9—12 μfd., 800-volt.
L—30 henrys, 150-ma.
R_1—5 megohms, ½-watt.
R_2—1600 ohms, 1-watt.
R_3—1 megohm, 1-watt.
R_4—200,000 ohms, 1-watt.
R_5—50,000 ohms, 1-watt.
R_6—500,000-ohm volume control (mike gain).
R_7—200,000-ohm volume control (line gain).
R_8—1500 ohms, 2-watt.
R_9, R_{10}—100,000 ohms, 2-watt.
R_{11}, R_{12}—500,000 ohms, 1-watt.
R_{13}, R_{14}—12,000 ohms, 1-watt.
R_{15}—120 ohms, 10-watt.
R_{16}—100 ohms, center-tapped, 10-watt.
J_1—Open-circuit jack (microphone).
J_2—Open-circuit jack (line).
B—9-volt battery.
M—0–500 d.c. milliammeter.
T_1—Class-B input transformer (U.T.C. PA-53-AX).
T_2—Variable-ratio Class-B output (U.T.C. VM-4).
T_3—Filament transformer, 10-volt.
T_4—Power transformer, 425 volts each side c.t., 200-ma.; with rectifier and 6.3-volt windings.

operation. It will be noted from the circuits that fixed bias is applied to the buffer and final grids when the key is open, preventing no-signal plate current, although most of the bias is obtained from grid-leak action when the excitation is applied.

The lack of plate-current milliammeters in oscillator and buffer circuits is a bit unusual, but not a great disadvantage. A portable milliammeter was inserted in these circuits when the first adjustments of the equipment were being made, and it is used each time a major change in the circuits is made. For tuning the transmitter, as when changing from one band to another, the grid-current meters are adequate indicators of operating conditions, since it is known from previous measurement that plate-current values accompanying resonance are safe. The meters used for measuring grid current could easily be switched to measure plate current of the first two stages. The voltmeter in the final-amplifier plate supply serves as a bleeder.

In the audio system as well as the r.f. portion of the transmitter, care had to be exercised to allow margins of safety for the components used, to provide for the more than usual heat in which the parts would be operated. First, modulator tubes capable of modulating 500 watts input without difficulty were needed, with required driving power and bias two important considerations. The ZB120 tubes seemed very suitable for this purpose, and were selected for the final audio stage. A simple speech amplifier which would give sufficient gain for the modern crystal microphones, and would easily drive the ZB120 tubes without too much distortion, was the next step. Type 6B5 tubes were chosen for the driver stage, reducing space requirements with the direct-coupled triode drivers, and providing characteristics suited to Class-B driver operation. With the concentration of magnetic fields unavoidable in such a transmitter it was considered important to avoid the use of any transformers for audio coupling, other than the Class-B input and output transformers. This suggested the use of either push-pull speech amplifiers throughout, or a phase-inverter such as one section of a Type 79 tube. The latter was chosen, chiefly because of space limitations, as well as the fact that the other section of the 79 tube used as a triode amplifier, together with the usual pentode first amplifier, would provide ample gain.

Reduction of size of power supplies, without sacrificing quality or the expectation of long,



REAR VIEW, SHOWING THE THREE DECKS

R.f. at the top, speech amplifier and modulator in the center, power supply at bottom. Note the ventilating fan on the upper right side of the cabinet.

trouble-free service, is a real problem. The choice of compact, oil-filled filter condensers accounted for greatest saving of space in the power supplies. The oscillator power supply was used also to provide grid bias voltage for the buffer and final amplifier when the excitation was removed from these stages. The loads of the modulator and the high-voltage radio-frequency stages could have been placed on one power supply, but the use of a separate supply for the modulator tubes is preferred. Common sense indicated that power transformers which would run at high temperature while operated in open air would not be at all suitable in such a transmitter as this.

TEMPERATURE CONSIDERATIONS

Although this transmitter was operated for many periods of several hours each before a fan was installed, with the door closed and the room at a comfortable temperature, using modulation with full input power, such operation is very improper. The temperature within the transmitter rose to very high values during these tests, and although no equipment was lost it is reasonably certain that much longer continuous operation of the transmitter would cause very destructive heat and that short life of the equipment could be expected. The transmitter cabinet is provided with louvres at top and bottom of each side; and in addition, the door at the back is punched, top and bottom, giving a cane-like area directly behind the rectifier tubes and the large tubes in the r.f. section. While convection currents were of considerable aid in removing heat from the transmitter, a fan was found to be a necessary addition. After thorough tests of the transmitter without special cooling aid were completed an eight-inch fan was obtained, and after some experiment to determine the position which would give most efficient cooling it was placed as shown in the back view, directly against the top louvres on the warm side of the transmitter. It is operated as an exhaust fan, causing a strong draft of heated air from the transmitter. The induction motor is connected so that it operates continuously while the filaments are heated. Even with the fan, the internal temperature in the transmitter is quite high, and for this reason the remarks in connection with conservative operation apply with the fan as used. A power of 200 watts is dissipated from the filaments alone, and all of 1750 watts except the actual average power delivered to the antenna transmission line is dissipated by the transmitter when it is operated as a 'phone unit.

COUPLING

It is very important that the coupling between the oscillator plate coil and buffer grid coil, and the coupling between the buffer plate coil and final amplifier grid coil, be very carefully adjusted to obtain optimum operation of these three stages. Once set, this adjustment remains fixed for all future operation, since the grid and plate coils mutually coupled are wound as single plug-in units, one for each band, for each coupling position. Thus, the optimum coupling is automatically obtained by simply plugging in the proper coils for any frequency band. As used in this transmitter, the coupling is so close that a very noticeable interaction of tuning exists between coupled tanks. In order to adjust the circuits to resonance, therefore, the two condensers—plate condenser of one stage and grid condenser of the succeeding stage—are adjusted simultaneously, the grid current of the succeeding stage being observed during the process. With this one exception, the usual process of tuning applies to this transmitter.

The antenna coupling arrangement is simply a single turn of wire placed inside each final-amplifier plate-coil form and located centrally within the winding. The coupling is varied by rotating the turn. The ends of the antenna coil are brought out through holes in the top of the form and are cut off so as to leave half-inch

lengths of wire protruding for terminals. The transmission lines used with the transmitter are of the low-impedance untuned type, concentric and twisted-pair, varying from 40 to 100 ohms impedance.

This transmitter as described, has been operated on the 3.5-, 7- and 14-Mc. bands. For output on any of these three bands, a crystal of either the output frequency or half the output frequency may readily be used, supplying sufficient excitation to the buffer to drive the final amplifier adequately for 'phone or code operation. For code work alone, frequency doubling may be used in both the Tri-tet oscillator and the intermediate amplifier, making it possible to operate the transmitter on twenty-meter c.w. with full half-kilowatt input, using an eighty-meter crystal in the oscillator.

The power which the transmitter may be expected to deliver to the antenna transmission line varies from 300 to 400 watts, depending on the care taken in making adjustments, and the frequencies of output and crystal.

To give definite information on the compactness of this transmitter, the following specifications are listed:

Height . . . . . 42 inches, overall
Width . . . . . 20.5 inches
Depth . . . . . 15 inches
Weight . . . . . 350 pounds, equipped for operation

Although it was originally feared that a transmitter as compact as this would be erratic in operation and require frequent repair, this unit has been giving consistent and dependable service. It made a very interesting experiment, with satisfactory results. If equipped with component parts specially suited to this type of construction, there is little doubt that extremely compact transmitters could be built to give complete satisfaction, using effective cooling means.

COIL DATA

Frequency		L_1	L_2	L_3	Separation L_2-L_3	L_4	L_5	L_6
3.5 Mc.	Turns	11	14	14	½"	15	19	24
	Length	¾"	¾"	¾"		3"	2½"	3¼"
7 Mc.	Turns	6	9	9	½"	15	19	12
	Length	⅝"	¾"	¾"		3"	2½"	3¼"
14 Mc.	Turns		6	6	⅜"	8	9	5
	Length		½"	½"		3"	2¾"	2"

L_1, L_2, L_3 — No. 18 wire on 1¾" diameter ceramic form.
L_4 — No. 12 wire on 4" diameter ceramic form.
L_5 — No. 12 wire on 2½" diameter ceramic form, concentric with L_4.
L_6 — No. 10 wire on 3" diameter ceramic form.

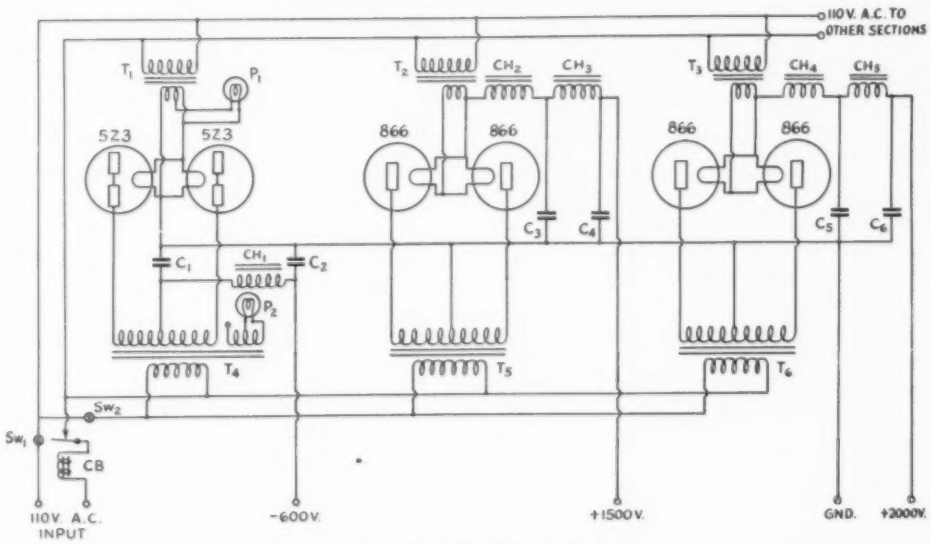


FIG. 3—POWER SUPPLY DIAGRAM

C_1, C_2—4-μfd., 1000-volt oil condenser.
C_3, C_4—2-μfd. 2000-volt oil condenser.
C_5, C_6—2-μfd. 3000-volt oil condenser.
CH_1—20-henry, 200-ma. choke.
CH_2, CH_4—18-henry, 300-ma. swinging choke.
CH_3, CH_5—12-henry, 300-ma. smoothing choke.
CB—20-ampere circuit breaker.
T_1—Filament transformer, 5 volts, 6 amp.
T_2, T_3—866 Filament transformer, 2.5 volts, 12 amp.
T_4—Plate transformer, 600 volts each side c.t., 200 ma., with 5-volt winding.
T_5—Plate transformer, to give 1500 volts d.c. at 500 ma. through filter.
T_6—Plate transformer, to give 2000 volts d.c. at 400 ma. through filter.
P_1, P_2—2.5-volt pilot lights.
Sw_1, Sw_2—Filament and plate control switches, s.p.s.t.

A Home-Built Velocity Microphone

Constructional Details of a Unit Built from Magneto Parts

By Norman E. Gibbs, W1JXP*

RIBBON microphones have always appealed to the writer because of their simplicity, ruggedness, and good frequency response. Construction of most types of ribbon microphones is quite simple. In essence the microphone consists of a metallic ribbon suspended between the poles of a magnet. Sound waves by their pressure cause the ribbon to move. It thus becomes a tiny

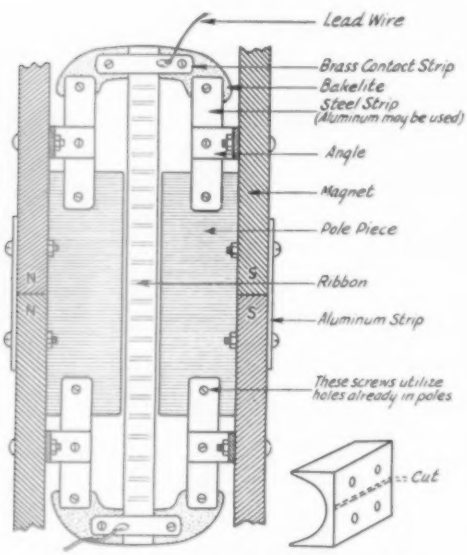


FIG. 1—VELOCITY MICROPHONE CONSTRUCTION DETAILS
Dimensions will depend upon the magneto parts used.

generator, since it is a conductor moving in a magnetic field.

The assemblies to be described were made as a result of an unhappy experience with a commercial velocity microphone purchased for use with a 'phone transmitter. The response was very poor and the hum level most annoying. Compared with other types it was a dismal failure. With the feeling that matters could not be made much worse the "mike" was pulled apart, the general idea being to see if the ribbon were correctly centered or if some reason could not be found for the poor operation.

The ribbon in question seemed rather lifeless and apparently was made of foil containing at least some lead as it was quite soft. A new one might effect a cure, so our experiments began at that point. The new ribbon made a new microphone out of the apparent "dud," but still the pickup was not as much as competing makes afforded. The idea of making an attempt at home construction became most attractive.

At the start several demands must be recognized:

1. The expense of construction must be low.
2. Only ordinary tools found in the usual home shop should be required.
3. The proper material must be utilized or success is nearly impossible. By proper materials of course is meant high-quality magnets, high-permeability steel for the pole pieces, and a foil from which to cut the ribbons which possesses proper mechanical and electrical characteristics.

SELECTING RIBBON FOIL

In the hunt for suitable foil for the ribbons, all sorts of metal sheet and foil were inspected. A good source which yields a surprising variety is blown filter and by-pass condensers (paper type). The following properties are demanded:

1. Lightness—a suitable foil is from one-third to three-quarters of a thousandth thick. Usually the thinner ribbons are more sensitive as there is less force required to move their lighter bulk—provided, of course, they possess the quality of elasticity.

2. Elasticity—springiness. Suitable foil makes a tinkling noise when a strip of it is waved with the hand. The noise is distinctly metallic and usually a foil giving this noise will have good tensile strength. A lead foil will not have the proper springiness, but may stretch if put under slight strain. A good foil, if slightly wrinkled, can be stretched in the same manner as a coil spring, provided the stretching is not too violent.

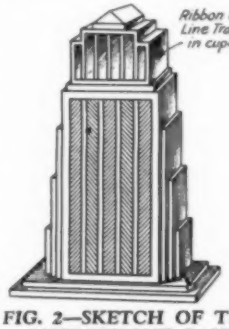


FIG. 2—SKETCH OF THE MICROPHONE CASE
It is made of wood, as described in the text.

3. High conductivity—a bright surface means good conductivity. Tin foil possesses this as well as the other properties. Aluminum foil is

* Old Lyme, Conn.

covered with a transparent coat of aluminum oxide which prevents good electrical contact. This oxide, by the way, causes the difficulties experienced in attempts to solder aluminum, as it forms almost instantaneously.

All in all, that "tinkle" sound is the best rule of thumb to use in judging material. Such foil keeps its bright surface, is easy to provide with proper contacts, and its springiness means lively response in the "mike."

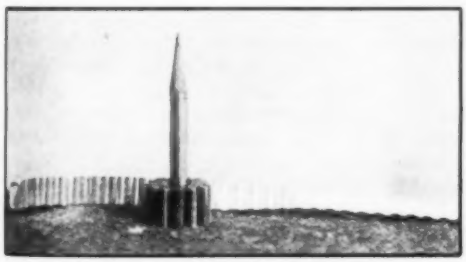
As a start it was assumed that, within limits, the better and stronger the magnets used the better would be the results. Also it was assumed that the material to be used for the pole pieces would have to be of high magnetic permeability. Obviously the cost of having steel pole pieces machined to order from a high-grade cobalt steel was out of the question.

At hand were two defunct marine magnetos; the magnets and pole pieces were obtained from these.[1] The poles are especially adaptable to our purpose and are of high-permeability steel anyway. Only a hack saw, emery wheel, hand drill, soldering iron, and the other usual and miscellaneous tools were at hand, nor are special tools required. The emery wheel is a necessity.

The following description of the steps taken in construction, together with the sketches and photographs, should give sufficient detail to enable any mechanically inclined person to build a presentable microphone.

MECHANICAL CONSTRUCTION

The magnetos are torn down, care being taken to keep all the machine screws. If desired your

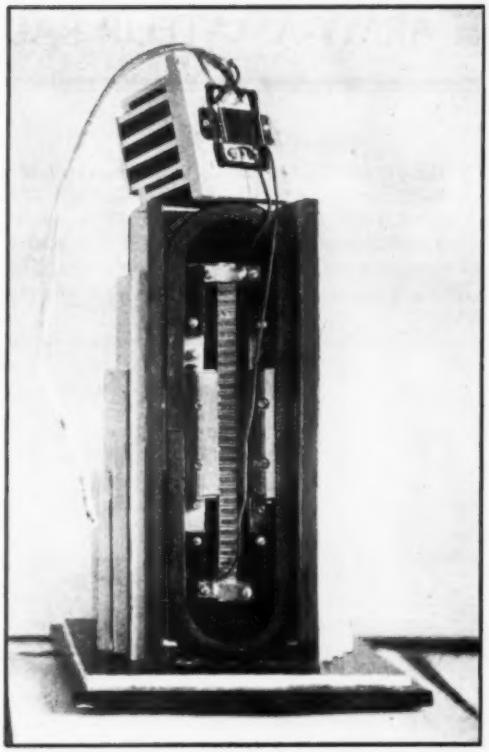


RIBBON AND CRIMPING TOOL

The tool is a small gear with a pencil stub as a handle. The crimping is done on a piece of soft felt.

local garage and ignition shop can boost the strength of your magnets by placing them in the field of a very strong electromagnet. In assembling the magnets to form an elongated oval be careful to place similar poles together so that the magnets tend to oppose one another. If your magnets tend to draw together you have them in the wrong position. In proper position we have a flat oval magnet with the poles at the junction (on each side) of the assembly. An aluminum strip is used to fasten the magnets together, the holes used being those already drilled for us.

[1] Almost any good-sized garage where electrical repair work is done should provide at least a source of information for tracking down a defunct magneto. There is no reason why types of magnetos other than marine could not be used as effectively. As to cost, the probability is that the price of old "mags" will be quite nominal and the entire unit can be built for less than $10. If the magneto is picked up for a song, $5 should suffice.



ASSEMBLED IN THE CASE, WITH THE FRONT GRILLE REMOVED

Note the ribbon-to-line transformer in the "penthouse."

We are now ready to prepare the pole pieces. Fortunately the poles are shaped down to a narrow edge, ideal for our purpose. Our task is to cut one of the magneto poles in half to furnish a pair for the microphone. This is accomplished with the emery wheel. With care a straight and fairly narrow cut can be made. The edges of the pieces should be ground as perfectly straight as possible so that when they are mounted the ribbon slot will have straight sides and not be wider at one end. The sketch shows where the cut is made.

Forming the pole and ribbon assembly is best explained by the drawings and photographs. A number of pieces of strip steel of the type used to bind the cores of b.c.l. power transformers, or strip brass or aluminum, together with angles of the same material, provide means for fastening the assembly rigidly. In the models built by the writer the clearance between the pole pieces was

(Continued on page 72)

ARMY-AMATEUR RADIO SYSTEM ACTIVITIES

Speed Contest Results

THE Seventh Corps Area is to be congratulated on winning the Code Speed contest (of December 6, 1937) with a total score of 482.4 points. They had ninety-one members participating with an average speed of 29.7 words per minute. The highest speed attained by them was 45 words per minute.

Complete scores for all Corps Areas are listed below.

CA	*Total Points*	*Participants*
I	112.1	20
II	156.0	41
III	289.8	54
IV	309.0	29
V	116.0	20
VI	112.5	30
VII	482.4	91
VIII	295.8	26
IX	268.0	96

W5GEY won first place in the individual scoring, having copied accurately sixty-five words per minute. He was awarded a "MacKey," which was donated by Terminal Radio Co., New York City. W4AFQ was second with a speed of fifty words per minute. He did not wish to compete in the individual scoring, having won a prize in last season's contest. The second prize, a Bliley Crystal, type LD2, donated by Harvey Radio Co., New York City, was awarded to W2BCX, who was next high with a speed of fifty words per minute.

The highest scoring A.A.R.S. members in each Corps Area are as follows, listed according to the length of copy made accurately at speeds indicated: First C.A.—W1BVR 40, W1AKS 40, W1JMS 40. Second C.A.—W2BCX 50, W2GGE 45, W2DBQ 40. Third C.A.—W3AKB 45, W3DNY 40, W3GKZ 40. Fourth C.A.—W4AFQ 50, W4AWO 45, W4AGI 40. Fifth C.A.—W9NGS 45, W8QLO 40, W8PWY 35. Sixth C.A.—W9DOU 40, W9YPI 40, W9SZL 35. Seventh C.A.—W5BMI 45, W9BNT 45, W9KCG 45. Eighth C.A.—W5GEY 65, W6KFC 50, W5OW 45. Ninth C.A.—W6GXM 45, W6BMC 40, W6CVL 40.

Non-member W9HUM of the Sixth Corps Area made best copy submitted, having copied one hundred words perfectly at sixty-five words per minute.

Following is quoted from the Eighth Corps Area Bulletin:

"We all have heard this recognized phrase, 'He is a fine op,' and we all would like to have this said about us. We have read about the ham who can copy fifty, and some of us have had the pleasure to know personally such operators. The height of every radio enthusiast's ambition is to make a real operator of himself, but very often the motive is speed only. The 'fast' boys will tell us that speed is all right only as long as accuracy is primary. The foregoing may seem rambling, but it ties up very definitely with what is to follow.

"In the A.A.R.S. are certain signals which are for convenience in operating. They are for the most part purely 'procedure' signals and are used in A.A.R.S. operations to save time. One Army man will doubtless think another a good operator if he is always on his toes and able to use correctly these signals.

"If you have been a careful listener, you have doubtless heard the above-mentioned signals used in drills which have no relation to the Army. It is this incorrect use of forms which will hurt many otherwise good men. When in a drill, or a net, please use the form that is set as standard for that particular net, and when operating in another net use the method prescribed for its operation. Do not mix operations. It will pull down your operating ability in the eyes of the fellows you work with.

"Another thing that seems to have a strong hold upon the activity this year is indifference towards schedules. One does not have to make schedules with a fellow ham just because he is asked to do so, but if the schedule is made, then keep it as regularly as possible. There are times when it is humanly impossible for us to make a program click, but a little time spent on a systematic arrangement of our working time, our radio time and our sleeping time will result in well organized system by which not only will the radio operating become more enjoyable and efficient, but also will the rest of the outside activities. It might be added that even though you are not so 'hot' when speedy operation is desired, regularity in operating will undoubtedly give you an excellent standing with other fellows."

NOTES AND COMMENTS

From reports submitted for a period of one month, the average amount of traffic originated, relayed and delivered by A.A.R.S. members is 1.58 messages per station per day.

Traffic reports submitted to Corps Area Signals should include all traffic handled by the station. Reports to A.R.R.L. should separate hamband traffic from that handled on the special frequencies. The A.A.R.S. uses A.R.R.L. method of counting traffic.

The main defect in many portable emergency rigs is that they are not portable.

"Accuracy First," and, "Reduce Delay Time" are written in neon lights in the War Department Message Center.

(Continued on page 82)

Speech Versus Sine Waves

A Discussion of Class-B Modulator Capabilities

By Earl I. Anderson,* W8UD

"A little knowledge is a dangerous thing". That, unfortunately, seems to sum up the situation with respect to the modulating capabilities of Class-B audio amplifiers. The fact that speech wave-forms contain, on the average, only about half the power of a pure tone having the same peak amplitude has led too many amateurs to jump to an erroneous conclusion. The author here reiterates, with examples, statements made in QST some two years ago—principles which have been overlooked in the search for something for nothing. Every 'phone man should read it.—EDITOR.

IT is a well-known fact that with a sine-wave signal in plate modulation, the audio power required for 100% modulation is 50% of the d.c. input to the Class-C stage. With voice input, however, the average audio power requirements are in the vicinity of 25%,[1] a condition which has led many amateurs to believe that a given Class-B audio stage will modulate twice as much r.f. input with voice as it would with a pure tone. For example, it is assumed that a modulator rated to deliver 100 watts of audio will modulate a 200-watt Class-C amplifier with sine-wave input, and a 400-watt amplifier with voice input.

Unfortunately, this is not true. Average output is no indication of the peak output if the wave-form is not known, and *peak* power is the important consideration. However, the shape of voice waves is such that, in general, the *average* power for a given peak power is only about half that for sine wave having the same peak power. But the peak power requirements for 100% modulation are the same regardless of wave form, so the same peak power is required whether the input wave form is that of a pure tone or speech. This means that a given modulator set-up can modulate 100% without distortion only a definite Class-C stage power input; this input remains constant and is not a function of wave-form or average power.

However, since with voice input the average power is less, it follows that the average plate dissipation is less. Consequently, if plate dissipation is the only limiting factor, the operating conditions can be revised to secure more output with voice input than with sine-wave input, because excessive heat will not be developed on the plates. On the other hand, not only plate dissipation but also filament emission and insulation in the tube must be taken into consideration. If the filament emission is adequate, the peak current value may be increased until either it or the plate dissipation become the limiting factors; or if the insulation in the tube is sufficiently good the plate voltage may be increased until either it or the dissipation become the limiting factors. Whether or not the peak plate current and plate voltage may be increased depends upon the characteristics of each individual tube type. Operation in excess of ratings should not be attempted in the absence of positive knowledge that it is permissible in the individual instance, and will not result in tube failure or increased harmonic content.

In other words, if the sine-wave ratings are conservative from the standpoint of voltage or current, or both, new operating conditions may be chosen to permit greater output with voice than with sine-wave input, by taking advantage of the reduced plate dissipation with voice. The correct operating conditions would be the same as for the same *peak* output with a sine-wave signal, and would be calculated exactly as described in a previous article.[2]

The essential formulas needed for any Class-B calculation are reproduced here for convenience:

$$I_{p_{max}} = \frac{I_{p_{av}}}{0.636}$$

where $I_{p_{max}}$ = peak plate current to each tube
$I_{p_{av}}$ = max. average plate current to both tubes with sine-wave input

$$E_{R_p} = I_{p_{max}} \times R_p$$

where E_{R_p} = peak voltage developed
R_p = reflected load impedance to one tube (one-fourth plate-to-plate value)

Minimum voltage drop across tube $= E_b - E_{R_p}$
where E_b = plate supply voltage

$$\text{Power output} = \frac{E_{R_p} \times I_{p_{max}}}{2} = \frac{I_{p_{max}}^2 \times R_p}{2}$$

$$R_p = \frac{E_{R_p}}{I_{p_{max}}}$$

plate-to-plate load $= 4R_p$

* Douglas, Michigan.

[1] Grammer, "Greater Economy in Class-B Modulator Design for Speech," *QST*, August, 1935.

[2] Anderson, "Class-B Audio Design," *QST*, August, 1937.

SOME PRACTICAL EXAMPLES

In general, tubes such as 203-A's with all leads out the base cannot be operated at greatly increased voltages because breakdowns in the base or socket, if not in the tube, may result. It may be possible to increase the peak plate current for increased output. At the maximum rating for 203-A's we find the following:

D.c. plate voltage	1250 volts
Max. average plate current (2 tubes)	306 ma.
Optimum load impedance (plate-to-plate)	9000 ohms
Power output	260 watts

Analyzing these figures, we find:

$0.306/0.636 = 0.482$ amp. peak plate current to each tube

$0.482 \times 9000/4 = 1080$ peak volts developed

$1250 - 1080 = 170$ volts minimum drop across tube

From the curves it seems safe enough to run the peak plate current up to about 0.7 amp. At the increased current the drop across the tube would be proportionately greater,[3] so

$$170 : x = 0.482 : 0.7$$

$x = 250$ volts drop across tube at 700 ma.

$$\text{Power output} = \frac{(1250 - 250) \times 0.7}{2}$$

$= 350$ watts

$$R_p = \frac{(1250 - 250)}{0.7} = 1430 \text{ ohms}$$

$1430 \times 4 = 5720$ ohms, plate-to-plate

By increasing the peak plate current and changing the operation conditions we have made it possible to modulate 700 watts input instead of the 520 watts possible under the sine-wave setup. Under these new conditions the maximum average plate current with sine-wave input for full output would be 0.7×0.636, or 445 ma. With voice input for the same peak output the maximum average plate current would be only about 50% as great. The 203-A filament will handle the 0.7-ampere peak plate current in good shape, and with voice input the average plate dissipation will be well below the ratings.

With a tube on which the plate voltage as well as the peak current may be increased, a much greater ratio of voice output to sine-wave output may be obtained. The T20 is an example of such a tube. Because its plate lead comes out the top the voltage may be increased greatly without fear of breakdown, and reference to the curves indicates that the filament is capable of emission far in excess of the requirements at the maximum rated output. The maximum sine wave ratings are as follows:

D.c. plate voltage	800 volts
Max. average plate current (2 tubes)	137 ma.
Optimum load impedance (plate-to-plate)	12,000 ohms
Power output	70 watts

Analyzing these figures, we find:

$0.137/0.636 = 216$ ma. peak plate current to each tube

$0.216 \times 12{,}000/4 = 650$ peak volts developed

$800 - 650 = 150$ volts drop across tube

Suppose we increase the plate voltage to 1000 without increasing the peak current.

$$\text{P.O.} = \frac{(1000 - 150) \times 0.216}{2} = 91.8 \text{ watts}$$

$$R_p = \frac{850}{0.216} = 3940 \text{ ohms}$$

$3940 \times 4 = 15{,}760$ ohms, plate-to-plate

Inspection of the curves shows that the peak plate current may be increased to 0.3 ampere safely. The drop across the tube will be proportionately greater

$$0.216 : 300 = 150 : x$$

$x = 208$ volts drop across tube at 300 ma. peak

At the increased plate voltage and current the calculation would be

$$\text{P.O.} = \frac{(1000 - 208) \times 0.3}{2}$$

$= 119$ watts

$$R_p = \frac{792}{0.3} = 2640 \text{ ohms}$$

$2640 \times 4 = 10{,}560$ ohms plate-to-plate

With sine-wave input the maximum average plate current would be 0.3×0.636 or 191 ma. and the plate dissipation would be greatly in excess of the rated value, but with voice input for the same peak output the maximum average plate current would be only about 100 ma. and the plate dissipation should be approximately the rated value.

In conclusion, it is possible to modulate more input to the final stage with voice than with tone modulation, but the operating conditions must be altered to permit increased peak output—and definite knowledge of the tube capabilities is absolutely essential. The assumption that twice as much input to an r.f. amplifier can be modulated with voice as with sine-wave input in the same setup is entirely without basis in fact, and can only result in serious distortion if attempted. For distortionless 100% modulation the input to the modulated amplifier must not exceed twice the audio *capabilities* of the modulator.

[3] This assumption is not strictly correct, since the proportionality will depend upon the tube characteristics. In practice, however, no error of any importance is introduced, since the load resistance and excitation changes necessitated by the new operating conditions operate to maintain the minimum plate voltage fairly close to its original value. —EDITOR.

A Universal Test Unit for the Study of Television Images

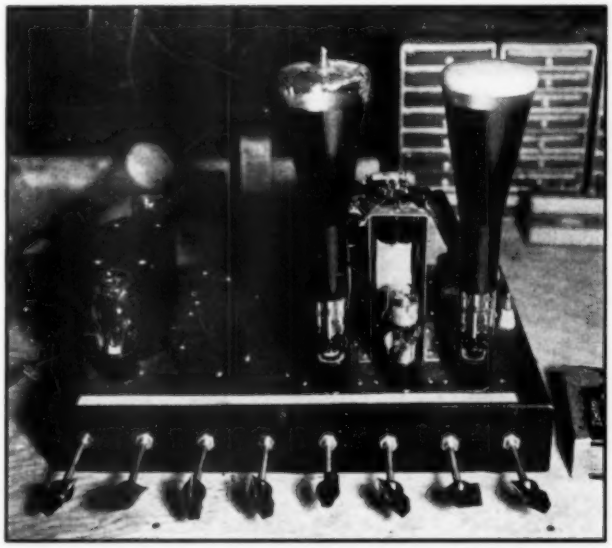
Sweep Circuits, Video Amplifier and an Image Generating Tube Combined in a Unique Set-Up

By Marshall P. Wilder,* W2KJL

At this stage the reader of this series of articles will have a general idea of modern television technique together with enough circuit data to permit him to build a complete receiver. The circuit material has been made intentionally very general in nature in order to facilitate the description of the functioning of the various components. We could, at this stage, proceed with a detailed constructional type of article describing a complete receiver. Since regular scheduled transmissions are still (at the time of writing) unavailable and since the sincere experimenter will demand a still more detailed understanding of practical circuit and adjustment procedure, we have decided to devote this article instead to the description of what can be considered a universal experimental set-up, built around inexpensive equipment and suited for use either as portion of a receiver, as a "test set" capable of producing a complete picture signal for the adjustment of receiving apparatus, or as the basis of an experimental transmitter.

This experimental equipment is built around a most fascinating device, recently perfected for television work, which is actually a test picture generator tube. The device, under the name "Monoscope," was described by Mr. C. E. Burnett of RCA at a recent convention of the Institute of Radio Engineers. The original tube was a very beautiful affair designed for use in the testing of commercial studio and transmitter equipment and was rather out of the reach of the amateur. The very great usefulness of this device, however, has led other manufacturers to undertake development work aimed at the production of a small and inexpensive unit. Two such tubes under development are the "Monotron" of National Union and the "Phasmajector" of the Allen B. DuMont Laboratories.

These test picture generator tubes consist essentially of an electron gun similar to that used in conventional cathode-ray tubes. This gun focuses a beam of electrons upon an aluminum disk mounted in the position ordinarily occupied by the fluorescent screen of a cathode-ray tube. The picture to be reproduced is printed on this disk. The electron beam is deflected with normal sweep circuits and as the beam crosses the picture, variations in secondary emission from the picture disk result. The secondary electrons emitted are either gathered on a conductive coating inside the tube or on a special collector element, and the video output voltage is obtained either from the picture plate or from the collector.



THE COMPLETE PICTURE GENERATING EQUIPMENT TOGETHER WITH A VIEWING TUBE: AN EXPERIMENTAL SET-UP OF THE EQUIPMENT DESCRIBED

Power supplies for the video amplifier, the sweeps and generating and viewing cathode ray tubes are at the left. The video amplifier (with one tube upside down to shorten wiring) is between the C.R. tubes. Sweep circuit gear is at the right rear. The plentiful controls are, of course, to facilitate experiment.

The output of the device is surprisingly high and the gain of an amplifier used to bring the signal up to a sufficient level to operate the control grid of the C.R. tube need not be greater than 25.

* 55 Kendall Ave., Maplewood, N. J.

The important feature of the whole development from the amateur point of view is that we are to have available an inexpensive method of producing a television signal which is certain to be of enormous benefit in facilitating experimental work. No longer need we wait for commercial transmitters nor, for that matter, need we give up hope of participating in television experiment just because we live beyond the range of the transmitters now operating. Even when we do have a commercial signal available, the new picture tube will make available a test picture of fixed and known quality with which accurate comparative work may be done. It is fortunate also that the necessary associated apparatus is relatively simple. And it is still more fortunate that the equipment built to operate the new tube is all entirely suitable for use in an experimental receiver.

In Fig. 1 is the complete circuit of a picture generating unit. It includes two sweep units, of the type described in the last article of this series, together with a two-stage video amplifier. Also, there is the necessary wiring for the picture tube itself. This unit, with a conventional three-inch cathode ray tube in place of the Monotron, becomes a television receiver by the addition of an r.f. section and a synchronizing pulse separation unit. On the other hand, it becomes a demonstration unit to allow the visual examination of the picture in the Monotron tube by connecting a three-inch cathode-ray tube to the 1000-volt supply, providing a separate voltage divider for focusing, then connecting the control grid of the cathode-ray tube to the output of the video amplifier. The output of the sweep circuits is connected, of course, both to the deflecting plate in the Monotron and in the cathode-ray tube.

Examination of the circuit will show that the sweep unit and the video amplifier correspond very closely to the circuits given in previous articles. Also, the arrangement of the Monotron portion follows exactly conventional cathode-ray tube practice. The only unconventional feature is in the arrangement used to extract from the sweep circuit suitable pulses for synchronizing and blanking. These pulses are obtained from the plate of the second tube in each sweep unit. In order to avoid interlocking between the two oscillators and to insure proper mixing of the two synchronizing pulses, the pulses are passed through a double diode before being mixed. They are then fed directly to the control grid of the Monotron in order to prevent the generation of any video voltage during the return traces of both sweeps. If this were not done, the video voltages would cause irregularities in the amplitudes of the synchronizing pulses. In order to get these pulses in the output of the complete unit, a small portion of the available pulse voltage is picked off a voltage divider and injected into the grid of the first

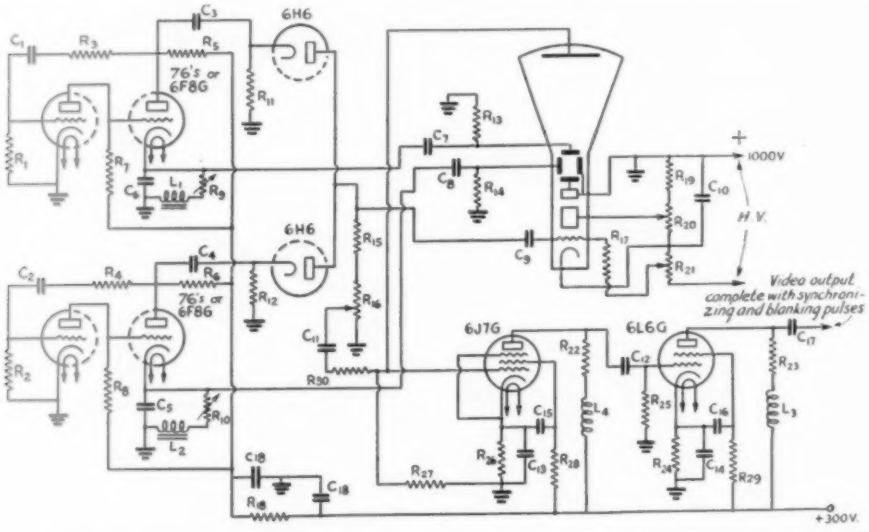


FIG. 1—THE COMPLETE CIRCUIT OF THE STANDARD PICTURE SIGNAL GENERATOR UNIT

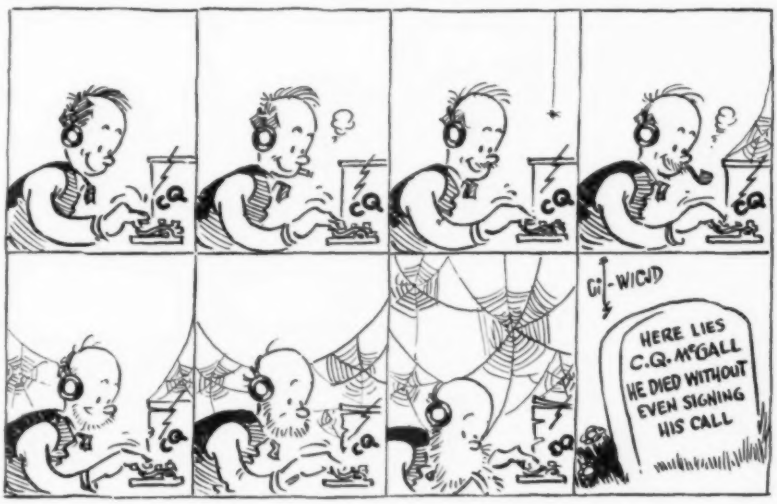
R_1, R_2, R_{11}, R_{12}, R_{13}, R_{14}, R_{25}—1 megohm.
R_3, R_4—4000 ohms.
R_5, R_6—2000 ohms.
R_7, R_8—100,000 ohms.
R_9—50,000 ohms.
R_{10}—150,000 ohms.
R_{15}—200,000 ohms.
R_{16}, R_{21}—10,000 ohms.
R_{17}—.5 megohm.
R_{18}—1500 ohms.
R_{19}—150,000 ohms.
R_{20}—75,000 ohms.
R_{22}, R_{23}—2500 ohms.
R_{24}—220 ohms.
R_{26}—1500 ohms.
R_{27}—25,000 ohms.
R_{28}—250,000 ohms.
R_{29}—30,000 ohms.
R_{30}—250,000 ohms.
C_1, C_2—.002 μfd.
C_3, C_4—.01 μfd.
C_5—.2 μfd.
C_6—.001 μfd.
C_7, C_8, C_{12}, C_{17}—.5 μfd.
C_9, C_{10}—1 μfd.
C_{11}—.25 μfd.
C_{13}, C_{14}—50 μfd.
C_{15}, C_{16}, C_{18}—8 μfd.
L_1—100 henrys.
L_2—2000 henrys.
L_3, L_4—100 microhenrys.

video amplifier tube along with the signals from the Monotron. The output of the video amplifier thus contains the picture voltages plus the synchronizing and blanking pulses. In other words, the output of the unit corresponds very closely to that obtained from the final video amplifier in a receiver tuned to a normal television signal. In setting up the equipment it is as well to have a three-inch cathode-ray tube available. This tube is placed in the socket ordinarily occupied by the picture generating tube and the sweep circuits are then adjusted until the usual scanning lines cover the desired area. Some workers will find it worthwhile to add adjustable positioning controls to permit centering the pattern—the necessary circuits being available in many pamphlets and books dealing with cathode-ray tube technique. With this setup the voltages on the cathode-ray tube may also be adjusted to give the desired brilliance and focus. The operation of the blanking pulses can be checked by removing the diode tube, in which case the return traces will be visible on the screen. All of this suggests that the device, in addition to serving its prime purpose of a picture signal generator, is also an excellent cathode-ray oscilloscope. Additional condensers may be provided in the cathode circuit of the sweep units to give a wide variety of frequencies and the video amplifier may be used to provide amplification of the voltage whose waveform is to be studied. Should the experimenter already have a complete oscilloscope it will not be necessary to build the entire rig. One additional sweep unit may be added to that already in the oscilloscope and the only additional item will then be the video amplifier.

In our experimental work the unit shown in the photograph has been used for a variety of interesting jobs. In its complete form it allows, in the first place, a very excellent demonstration of the fundamental principles of transmission. Also, it immediately permits an examination of the capability of both the Monotron and the cathode-ray tube in resolving a television image. The pattern provided on the picture tube is sufficiently complex in its drawing so that it is possible to receive all the details present only if the equipment is excellently adjusted. Incorrect sweep amplitudes immediately become apparent as a distortion in the breadth or height of the image. Poor high-frequency response in the video amplifier is indicated by poor definition on the edges of lines—particularly when they are vertical. Phase shift is indicated by the edges being reversed in color or by the lines themselves being shifted slightly to the right—giving a ghost of the pattern displaced slightly from the original. Then, the ability of the screen, tube and coupling circuit to reproduce good tone values can be tested by observing whether or not any halftones in the original can be duplicated in the final picture.

The unit is essentially a device for facilitating the construction and adjustment of television receivers, but one needs little imagination to visualize it as a source of modulation for a ham television transmitter. Indeed, such equipment has already been used by some of us for preliminary experimental work with considerable success. This is not to say that the day of practical amateur television transmission is here. This gadget permits the transmission of a single picture only and we must await the development of inexpensive Iconoscopes before the reproduction and transmission of moving images becomes possible. It is important to realize, though, that the necessary technique is being given close study and that before very long we shall find amateur television transmission to be not much more complicated nor much more expensive than 'phone transmission is to-day.

In the meantime, we firmly suggest that the television enthusiasts should study and possibly duplicate a unit such as that described. Its operation will give him a very intimate picture of many of the details of television technique which are so difficult to assimilate in any other fashion and will provide him with units suitable for immediate application to experimental reception.



A Pack Set for 200 and 300 Megacycles

Completely Portable Transmitters Using Acorn Tubes

By L. C. Sigmon,* W9YNJ

ALTHOUGH the 300- and 200-megacycle transmitters to be described were designed primarily to be used in a relay broadcast pack transmitter, I believe the description and results obtained will be of interest to every amateur interested in the development of the ultra-high frequencies.

Experimental work was first started in the early part of the summer of 1937 under my amateur license. At that time breadboard models of the ultra-high-frequency transmitters and receivers were constructed. The results obtained were so promising that two experimental licenses were applied for by the KCMO Broadcasting Company for relay broadcasting purposes. The license called for four experimental frequencies—100, 200, 300 and 500 megacycles. To date all frequencies except 500 megacycles, or 0.6 meter, have been used with excellent results for relay transmissions over short distances, the distance depending upon the frequency, power and location.

At the present time not enough work has been done on the 500-megacycle receiver and transmitter to go into details about it, except to say that the most promising receiver so far constructed seems to be of the type having tuned lines in the plate and grid circuits, similar in construction to the 300-Mc. transmitter shown in Fig. 3.

The complete pack set consists of the main case containing a receiver, modulator and "A" and "B" batteries, and separate transmitters which can be attached to the top of the case. The same transmitter circuit is used for both 200 and 300 Mc., the difference being simply in the size of the linear tank circuit. The complete circuit diagram is given in Fig. 2.

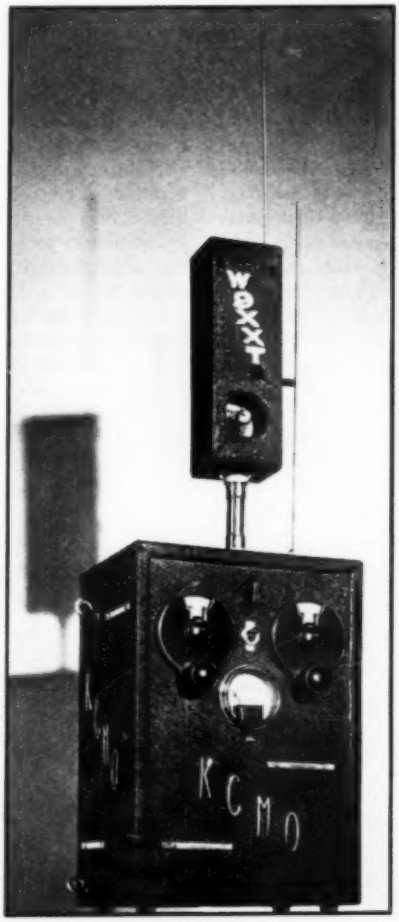


FIG. 1—THE COMPLETE PACK SET

The 300-Mc. transmitter is in the small box on top of the pipe. The main case contains a receiver, modulator and batteries for plates and filaments.

LAYOUT DETAILS

Fig. 1 is a picture of the pack set with the 300-megacycle transmitter attached to the projecting pipe. Each end of the pipe is fitted with a four-prong plug so that transmitters of different frequencies may be plugged in. The antenna projecting out of the transmitter is a quarter-wave rod. The antenna to the right, for receiving, also is a quarter wave. All transmitting controls are locked in place after the transmitter is set on frequency. The modulating unit is enclosed in the upper left-hand corner of the pack transmitter proper; the upper right-hand part contains the receiver. The meter on the front reads the total plate current of both transmitter and receiver, the current being approximately 19 ma. The left-hand dial is the regeneration control and the right-hand dial is the receiver tuner. The central bar knob is the audio gain control. The switch breaks both the "A" and "B" voltages. The lower part of the pack transmitter contains three Burgess "B" batteries, No. Z30P, each battery 45 volts, and two Burgess No. F2BP "A" batteries, these being 3 volts each. The total weight of the batteries is only four pounds, eight ounces. In testing the pack transmitter a small power supply was constructed to replace the batteries.

The jacks for the microphone and headphones are located in the left- and right-hand corners on top of the

* Chief Engineer, KCMO, Kansas City, Mo.

pack unit. The back plate of the transmitter pack is attached with self-tapping screws. Four rubber sponges are provided, one on each corner of the back plate, so that the pack will fit comfortably on one's back. A double-button carbon microphone is used. The reason for elevating the transmitter above the pack is so that the antenna projecting from the top of the transmitter will be clear of the person wearing it, and also others in the vicinity.

THE TRANSMITTER CIRCUITS

Fig. 3 shows the 300- and 200-Mc. units uncased. The construction is almost self-explanatory from the pictures. The tuned line in the grid and plate circuits was used to provide the degree of frequency stability required by the Federal Communications Commission, as well as to obtain maximum circuit efficiency. The rods used are ⅜-inch solid brass, and less than ⅛-wavelength long. The spacing between centers of the brass rods is ¾ inch. The distance between the rods can be varied, but with greater spacing longer rods will be required.

The problem of insulation is not serious at the ultra-high frequencies with the type of construction shown. The voltage is slightly less than maximum at the tube socket and is minimum (a voltage node) at the ends of the rods. A standard Mycalex socket is used for the 955 acorn tube. The insulators at the end of each rod are inexpensive ameroid pillars. The condenser shunted across the ends of the grid and plate rods is a special high-frequency unit, but a standard mica postage-stamp-size condenser will work as well.

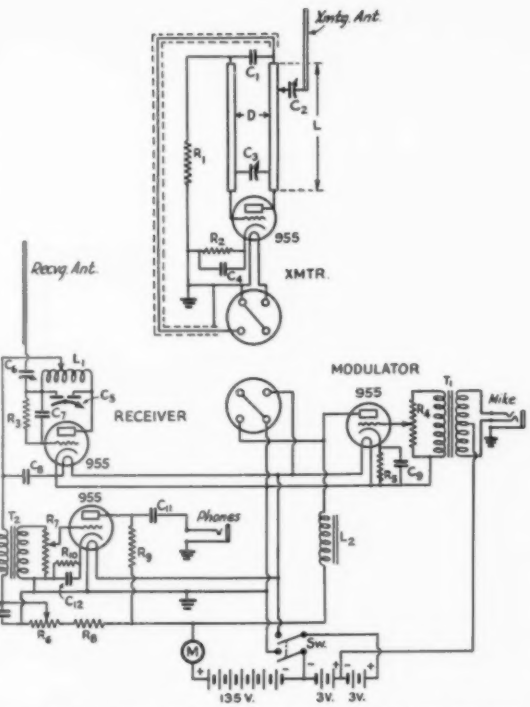


FIG. 2—CIRCUIT DIAGRAM OF THE PACK TRANSMITTER AND RECEIVER

C1—100-μμfd. (Cornell-Dubilier with low-loss case).
C2—30-μμfd. padder (National M-30).
C3—Tuning condenser. (See text and photos.)
C4—0.01-μfd. paper.
C5—Special split-stator (Cardwell ZR-15-AS with stator cut in center).
C6—30-μμfd. padder (National M-30).
C7—50-μμfd. fixed (Cornell-Dubilier with low-low case).
C8—0.003-μfd. mica.
C9—25-μfd. electrolytic.
C10—0.5-μfd. paper.
C11—0.01-μfd. paper.
C12—25-μfd. electrolytic.
L—⅜-inch brass rods, length 3¾ inches for 300 Mc., 6 inches for 200 Mc., spaced ¾ inch.
L1—4 turns No. 18, diameter ¼ inch, tapped at center.
L2—A.f. choke (Stancor C-1003).
R1—5000 ohms, ½-watt.
R2—450 ohms, 1-watt.
R3—10 megohms.
R4—100,000-ohm midget variable (Centralab N-117).
R5—1000 ohms, 1-watt.
R6—50,000-ohm midget variable (Centralab N-114).
R7—500,000-ohm midget variable (Centralab N-103).
R8—20,000 ohms, 1-watt.
R9—75,000 ohms, 1-watt.
R10—5000 ohms, 1-watt.
T1—D.B. microphone transformer (U.T.C. CS-5).
T2—Audio transformer, 3:1 ratio.
M—0-25 d.c. milliammeter (Readrite).
Sw—Battery switch, d.p.s.t.

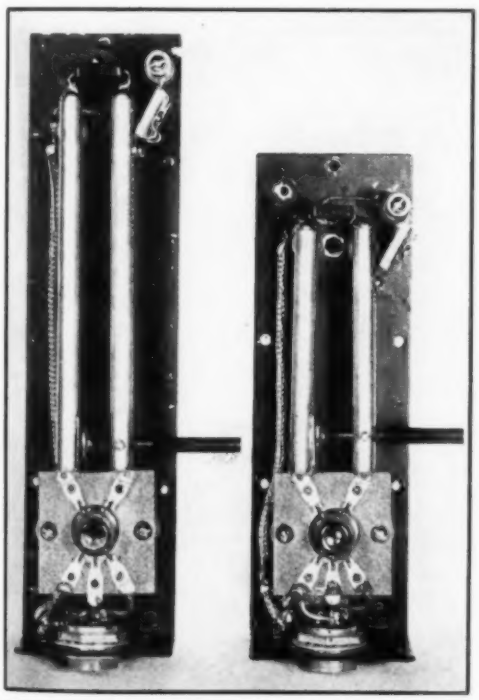


FIG. 3—THE 200- AND 300-MC. TRANSMITTERS

Either may be plugged into the top of the main case. Both use resonant-line oscillator circuits with 955 acorn tubes.

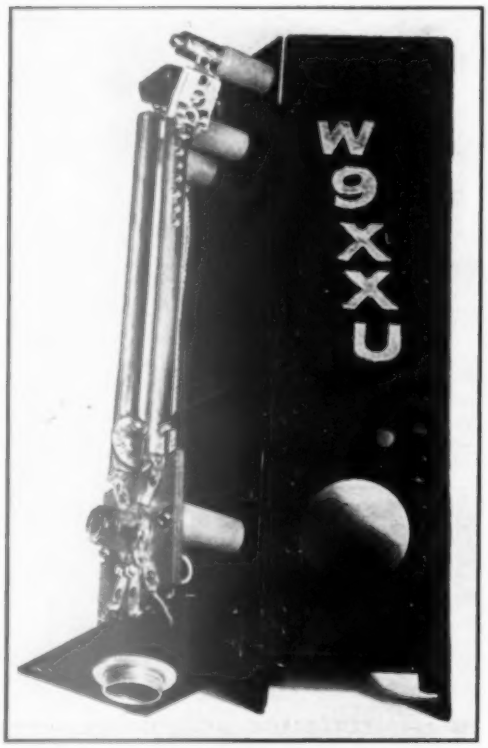


FIG. 4—A SIDE VIEW OF THE 200-MC. TRANSMITTER
Showing how the assembly is mounted to the base plate.

It was found necessary to shield the plate voltage lead. If this is not done standing waves will appear in power leads, and a number of undesirable effects may be expected. The transmitter should only be grounded at one place on the chassis, this being near the grounded filament lead. The shield over the plate voltage lead should also be grounded at the filament lead and the remaining part of the shielded lead insulated from the chassis.

Tuning of the transmitter is effected by means of a penny soldered off center to an 8/32 threaded brass rod. The reason for the penny being soldered off center is to give a vernier tuning effect. Another small plate is soldered to the grid rod to complete the tuning condenser. The details of this construction are shown clearly in Figs. 3 and 4. The plate rod is also tapped for 6/32 screws at intervals of a quarter inch, for a length of approximately an inch and three-quarters from the low-voltage end. This is to locate the proper coupling point for the antenna condenser. Some difficulty was experienced when the oscillator was encased, and those not intending to encase the oscillator will find it necessary to extend the length of the rods slightly. The transmitter proper is constructed on No. 16 gauge aluminum, but copper is preferable when weight is not an important factor. The main case of the pack transmitter is made of No. 22 gauge cold rolled steel.

The modulator unit is of the Heising type, using another 955 tube. The rest of the circuit is self-explanatory.

OPERATING DATA

The quality of voice transmission from the transmitter is good, provided the transmitter is not modulated too heavily. The chief source of distortion is the non-linear characteristic of the regenerative detector used in the receiver. If a low percentage of modulation is used the distortion is not objectionable. All programs broadcast from the relay pack transmitter go through an equalizing circuit which also helps to improve the quality of transmission from the pack.

The greatest distance so far tried for reception was three-quarters of a mile over open country. No doubt greater distances can be covered with higher power. The approximate power of the transmitters is 0.1 watt.

The purpose of the 300- and 200-Mc. pack transmitter at KCMO is not to cover a great distance, but for use inside large auditoriums and for man-on-the-street broadcasts, etc., where it is ordinarily necessary to use several hundred feet

(Continued on page 88)

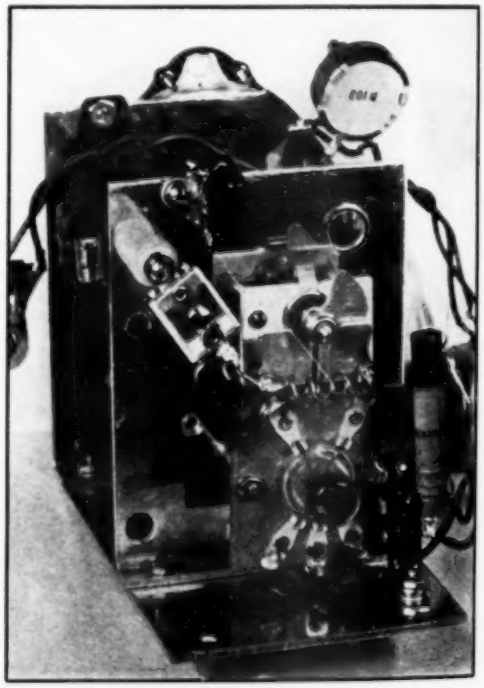
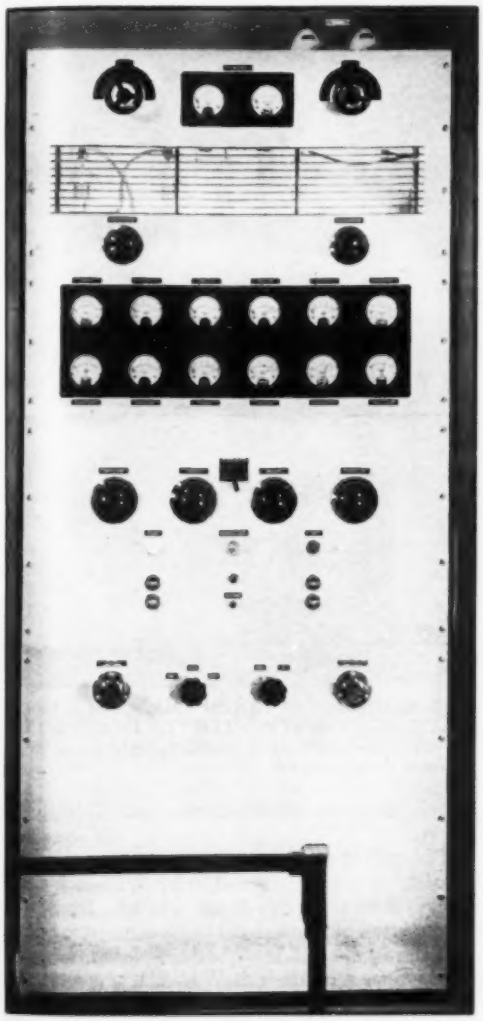


FIG. 5—THE RECEIVER REMOVED FROM THE MAIN CASE
The superregen tube is a 955.

Amateur Radio STATIONS



BLACK BAKELITE CONTRASTS STRIKINGLY WITH THE ALUMINUM PANELS OF W9AXH'S TRANSMITTER

The meter panels are set behind glass windows.

W9AXH, Indianapolis, Indiana

WHILE all of us admire commercial-built equipment and usually try to emulate it in our own construction, comparatively few are adept enough to reach the point where visiting hams refuse to believe our rigs are home-made. That, however, is the case with the transmitter recently constructed by W9AXH, Robert E. Stuart, of Indianapolis, Ind., of which two views are shown in the accompanying photographs.

The complete transmitter, used for both 'phone and c.w. in the 80-, 40- and 20-meter bands, is contained in a metal cabinet 78 inches high by 37 wide and 17 deep; three shelves and the base hold the various sections of the outfit. The front panels are made of 3/16-inch aluminum, each 36 inches wide. The final stage, using two 150T's in push-pull, can be operated at inputs from 350 watts to a kilowatt, and is modulated by a second pair of 150T's. A 53 oscillator-doubler, 801 buffer, and 100TH driver complete the r.f. line-up. The audio end built into the transmitter consists of two 76's in push-pull followed by four 2A3's in push-pull parallel which feed the modulator grids.

Looking into the back of the transmitter, the top shelf carries the antenna tuning condenser (used only on 80 meters), final stage and the modulators. A homemade dual fixed condenser, 50 $\mu\mu$fd. per section, is beside the variable plate tank condenser, a Johnson 50-$\mu\mu$fd. per-section unit, and can be connected in to increase the tank capacity for 80-meter operation. The tank coil plugs in directly below the tank condenser. The neutralizing condensers and filament transformer also are on this shelf. The grid tank for the final is underneath the shelf, link-coupled to the 100TH driver on the next deck below.

All r.f. stages except the final are on the second shelf. At the left is a crystal oven containing four air-gap holders which are adjustable through the top of the oven. The 53 oscillator-doubler with its tank coils, and the 801 buffer and tank, occupy the space between the oven and the shield which separates the 100TH driver from the exciter. Between the exciter and front panel is a shielded compartment containing the audio driver for the modulator, and also power supplies for the driver and the r.f. exciter. The Class-B input transformer is mounted underneath the top shelf and is fed through a shielded line from the 2A3 plates.

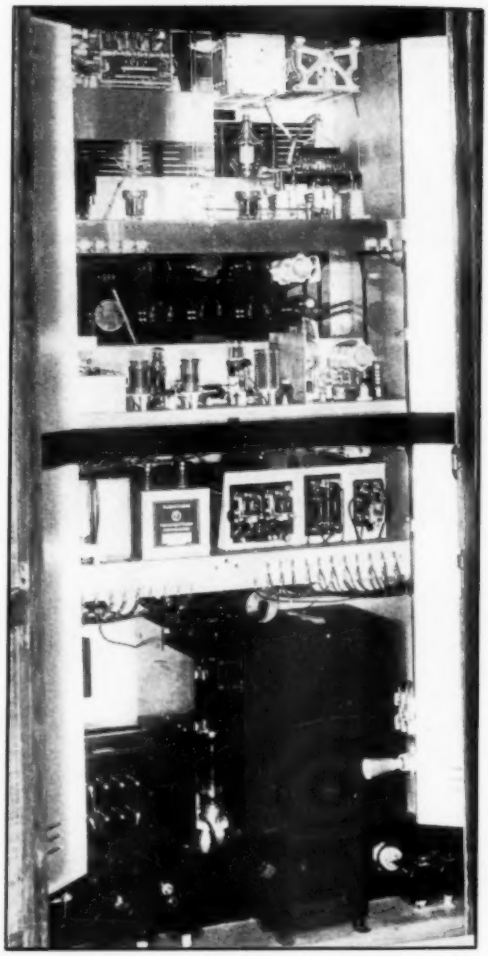
Filter components are contained on the third shelf. At the left are two 3500-volt 2-μfd. oil-filled condensers which are connected in parallel

to form the filter output; the input condenser consists of two 3000-volt 2-μfd. units connected in series. The input swinging choke is 5–20 henrys at 1 amp., the smoothing choke 20 henrys at the same current. The panel to the right on this shelf holds several control relays; that at the left is a Ward-Leonard time-delay for the 872 rectifiers, followed by a Leach keying relay and a Dunco 30-amp. unit for primary control of the plate circuits. On the other side of the panel (not visible in the photograph) are a second 30-amp. Dunco relay for filament control, a homemade relay for the crystal temperature oven, underload relay for the bias circuit, overload relay for the final-amplifier plates, and overload relay for the modulator. The round can below the shelf contains a switch, operated simultaneously with a voltage-changing switch on the high-voltage supply, which changes the bias on the 150T's to correspond with the plate voltage in use.

The largest item on the bottom shelf or base is the plate transformer, specially built for this transmitter. It is a 3-kva. job with 110–220 volt primary, giving secondary voltages of 3200, 2500 and 1870 each side of the center tap for d.c. voltages of 2500, 2000 and 1500 volts, at a maximum current of 1 ampere. Additional plate-voltage variation in steps of 100 volts to a maximum of 500 either way from these main voltages can be secured by means of an auto-transformer connected in the primary circuit of the plate transformer. The 872 rectifiers are between the transformer and the large baffle. Homemade 1-amp. high-voltage fuses are in series with the rectifiers for protective purposes. The 110–220-volt power connections, remote-control and keying leads, and the 500-ohm audio line are brought in the bottom through appropriate plugs. The transformer at the left is the UTC Class-B output transformer, wound for three different impedances to take care of the power inputs at the three main plate voltages available. The rear doors, four in number, are interlocked with the high-voltage so that the power is cut off when a door is opened.

The front view shows the layout of controls. Radiostats are provided for filament-voltage adjustment on the 872's and 150T's; these, with the plate-voltage change switch, are on the bottom panel. In addition, a switch is provided for shorting the Class-B output transformer for c.w. operation. The square plate in the center of the second panel is a four-position switch for selecting various crystals in the oven. The exciter tuning controls, along with filament and plate on-off controls, also are on this panel. The power controls are duplicated on the operating table.

Meters for the various stages are behind the glass window in the third panel. All significant grid and plate circuits are metered, along with the filaments of the larger tubes. The tuning knobs for the final stage and antenna are on the top



THE REAR VIEW IS TAKEN THROUGH A DOORWAY WHICH IS NOT PART OF THE TRANSMITTER

Four doors, with safety interlocks, give access to the inside of the metal case.

panel. Antenna ammeters are behind the glass insert.

The grill through which the 150T's are visible consists of a number of 3/8 by 3/16-inch brass strips separated by brass blocks. Rods run through the blocks to hold the assembly together, and the whole grill is chromium plated.

The operating desk at W9AXH, not shown in the photographs, is directly in front of the transmitter. The receiver, an HRO, is mounted at the bottom of a 30-inch desk-type relay rack. Additional units mounted on the rack include a power supply for the receiver and speech preamplifier; a permanent-magnet speaker; the preamplifier, consisting of a 6J7 pentode-connected working into a second 6J7 triode-connected, the latter feeding a 500-ohm line to the

(Continued on page 106)

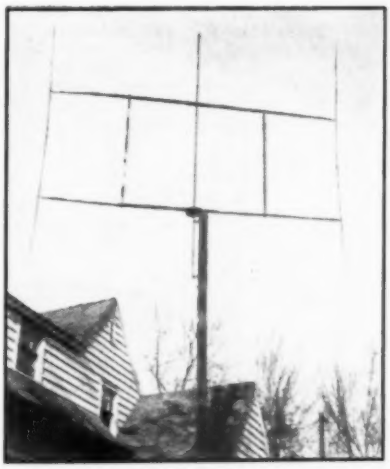
A Continuously-Rotatable 28-Mc. Beam

Rapid Rotation—No Stops—Stationary Feeders

By A. F. Neuenhaus,* W2BSF, and M. E. Schreiner,** W2AJF

DURING the winter of 1935, twenty-meter QRM drove W2BSF and W2AJF to the five-meter band for local QSO's in an effort to alleviate the situation, and it proved a most interesting and instructive experience. Our work there proved to us that though the "big kilowatt" will usually plough through, a certain bit of skywire called the "antenna" has more to say in getting out than most of us are willing to concede.

The ten-meter band was opening up with its splendid possibilities, but our experience with 20 and 40 had taught us what to expect when it began humming. Here was a band that surely would place the world at our "mike-tips," but again the big kilowatt signals, which we could not afford, cast a menacing shadow across our anticipations. (We take no issue with the truth that high power, properly adjusted, causes less QRM outside its own frequency than a carelessly-adjusted rig of a few watts.) However, what five meters had taught us could be put to work on ten, and we had convinced ourselves there that the power we cannot afford in the transmitter can certainly be built into the antenna at a cost well within the reach of the average ham's pocketbook.



THE 28-Mc. ROTARY BEAM INSTALLED AT W2BSF

A unique feature of this arrangement is the stationary antenna, with the reflector and director rotating around it. This construction simplifies the feeding problem.

Of all the arrays and beams we had tried, seen, heard or read of, the one that seemed to have the greatest possibilities for enhancing our chances of successful QSO's in any desired direction with a moderate amount of power, was the reflector-director type. It had a particular appeal to us, especially from the viewpoint of its unidirectivity, which very effectively eliminates QRM in undesired directions, and under normal conditions it has worked out exactly the same way on the reception of signals here. In other words, the incoming signal at which the array is pointed is built up while signals from other directions are attenuated to a considerable degree.

Rotatable beams and more of them have put in their appearance and many a fine signal from them has buffeted our speakers around, but most of the designs were too cumbersome for our locations and expensive for our purses. Then, too, the everpresent problem of dangling feeders makes it impossible to rotate these beams completely and continuously through 360 degrees. Stops of various kinds were annoying for the reason that it very often proves necessary to rotate these antennas through 300 degrees to effect a 60-degree change in directivity. Motors, of course, may be used to do most of the work, but they must be reversible in one form or another, thus adding expense.

After all these considerations, it occurred to us that the vertical reflector-director set-up afforded a means of overcoming all of these handicaps and also provided a splendid method for avoiding the usual dangling feeder. In addition, it would give us our long-sought continuous and complete rotation right through 360 degrees in either direction. Instead of rotating the antenna, why not simply rotate the reflector and director around a stationary half-wave "J" antenna and feed through the conventional open-wire transmission line? We immediately got to work and constructed such an affair, and it has been in operation at W2BSF for the past two or three months. To make a long story short, we have been so completely satisfied and gratified with the results, that our immediate thought was to pass it along to our fellow-hams through the medium of our old friend *QST*.

Actual measurements and, above all, received S-meter readings in all parts of the country and as far away as Honolulu, have shown the beam to have a gain of 4 db over the regular di-pole at the same elevation and with the same power. The front-to-back ratio is at least 16 db. To appease those fellows who entertain worries about vertical polarization, let us say that tests have proved that, outside our own district, the vertical

* 34 Sylvester Ave., Hawthorne, N. J.
** Prospect St., Little Falls, N. J.

polarization effects are negligible, the signal strength maintaining the same level with both horizontal and vertical receiving antennas at the same station. Locally—within a 25 or 30 mile radius—vertical polarization effects are noticeable, but do not seriously affect the signal strength.[1]

A duplicate of this antenna is in process of construction at W2AJF at the present time and will include some minor improvements and refinements which are shown in the accompanying drawings. Incidentally, this beam can very easily be rotated completely through 360 degrees in either direction, or stopped at any intermediate point, in less than five *seconds!* Following is a description of the details of construction:

The dimensions of all elements of the system are calculated strictly in accordance with formulas (for desired frequency) contained in the 1938 A.R.R.L. *Handbook*.[2] The 4-inch by 4-inch mast is 20 feet high so that when complete the antenna will be one-half wave above ground. The half-wave antenna portion consists of a 12-foot length of 1-inch O.D. aluminum pipe, ⅛-inch wall, with a brass reducer fitted to the top. A ½-inch I.D. brass nipple is fitted with two set screws and screwed into the reducer. The 7/16-inch O.D. aluminum can be cut to any length above 5 feet and will slide nicely into the brass nipple, making it possible to adjust the half-wave antenna to the proper length and fasten the sliding section with set screws. The 1-inch aluminum pipe will fit through the insulator-block bushings and pulley, which are bolted to the lower horizontal member.

(*Continued on page 115*)

[1] In sky-wave transmission, the polarization of the received waves seldom bears any definite relation to the polarization of the transmitting antenna. From this standpoint, it is a matter of indifference whether horizontal and vertical antennas are used. Ground losses are probably lower when the wire is horizontal, and there is less likelihood of interference with nearby receivers.—EDITOR.

[2] The recommended director spacing in the *Handbook* is ⅓ wavelength; optimum spacing, however, usually is obtained only after a period of cut-and-try. In connection with element lengths and spacings, there is the possibility of improving the gain of an array of this type by using the spacings and tuning conditions derived by G. H. Brown and described in the *Proceedings of I.R.E.* for January, 1937. For example, when only a single parasitic element is used, maximum gain is secured with spacings of the order of 0.1 wavelength, the parasitic elements being adjusted to have the proper reactance for either forward or backward radiation. In the special case of self-resonant parasitic elements (length same as that of antenna) optimum spacing for functioning as a "director" is 0.1 wavelength; as a "reflector," 0.2 wavelength; in both cases the gain is quite near the maximum possible. Where more than one parasitic element is used, the mutual impedances between all elements of the array must be considered in determining optimum spacings and tuning conditions.—EDITOR.

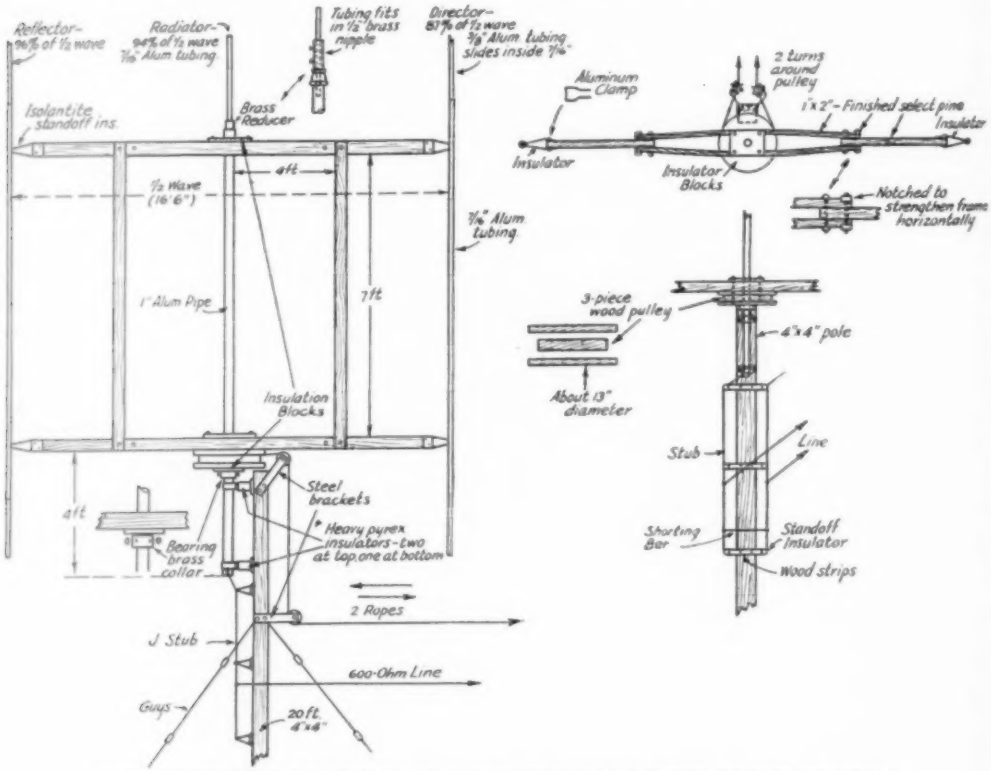


FIG. 1—DETAILED DRAWINGS OF THE ESSENTIALS OF THE ROTATING BEAM

A Solution to the Tank Circuit L-C Ratio Problem

Variable-Range Condenser for Multi-Band Transmitters

By Frank Lester,* W2AMJ

THE old adage, "necessity is the mother of invention," applies in this case for it was because of a job given to the writer that this idea developed. To the best of my knowledge the plan about to be discussed has not appeared in print, nor has it been applied to amateur transmitters. Why this should be so is rather puzzling, for the idea is so simple that it is a wonder several of us have not thought of it previously.

It is a well-known fact—only too well known—that we require an entirely different order of tank capacity for 56 Mc. than for 1.75 Mc. It is also common knowledge that lead lengths and stray capacities play an increasingly important part the higher in frequency we go. Heretofore, because of the fact that maximum efficiency is always the ham's requirement, two or more amplifiers have been necessary when such a wide frequency range was desired. The plan to be discussed tends to eliminate the need for separate final amplifiers when a wide frequency range is to be covered.

Now to get down to business. In this case it is advisable to reverse the usual procedure and consider the low-frequency end first. Let us assume that we want to operate on 1.75 Mc., and also that a fairly good *L-C* ratio will result if we have approximately 100 $\mu\mu$fd. of effective tuning capacity, utilizing a split-stator condenser (i.e., 200 $\mu\mu$fd. per section). Usually it will be found that the minimum capacity of such a condenser is too high to permit good *L-C* ratio on 56 Mc. There is, however, nothing to prevent our taking each one of the sections of this large condenser and splitting it into two parts, which means that we will have three capacity ranges available to cover the six amateur bands. This is just exactly what has been done, and when the construction of the majority of popular variable condensers is considered it can readily be appreciated that the job is not a difficult one. Therefore the cost is small and at the same time one amplifier can be made to function with good efficiency where two or three previously had to be employed.

Fig. 1 shows the entire circuit. All that is needed in addition to the special condenser is a new plug-in coil assembly. This should have seven plugs to take care of connecting in the desired capacities throughout the frequency range from 56 to 1.75 Mc. Obviously, on 56 Mc. the pair of small sections of the variable condenser will be employed. The same capacity also may be used for 28-Mc. operation, although the designer has the choice of using these or the larger sections, depending upon whether a low-*C* or a high-*C* circuit is desired. Depending on the wiring of the plug-in coil strips, we may use either the small sections, the large condenser sections or the two in parallel on each side. Each section of the original condenser should be cut so that optimum capacity values can be obtained throughout the frequency range.

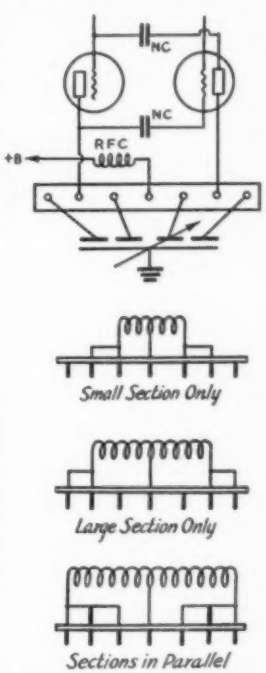


FIG. 1—THE FOUR-SECTION CONDENSER CAN BE USED TO GIVE THREE CAPACITY RANGES IN CONJUNCTION WITH COIL STRIPS HAVING SEVEN PLUGS

The wiring shown automatically cuts in the desired capacity when the appropriate coil is plugged in.

With the coöperation of the Hammarlund Manufacturing Company, a sample condenser was made up to the writer's specifications. To give an idea of the capacity ranges possible, these are the actual measurements of the sample condenser:

Using the high-frequency condenser sections, the minimum capacity is 8, the maximum capacity 24.5 $\mu\mu$fd. The capacity range of the larger sections—which we will term the "middle frequency" condenser—is from a minimum of 11½

* 103 Williamson Road, Bergenfield, N. J.

† Aside from greater ease of tuning at the higher frequencies with condenser of small capacity range, the merit of the scheme can be judged by comparing the minimum capacity of the smaller sections in series with the minimum capacity of the condenser as a whole without alteration. In the condenser discussed, this "improvement ratio" is better than 2 to 1. —Editor.

to a maximum of 82.5 $\mu\mu$fd., while with the two sections connected in parallel on each side the range is from 19.5 to 103 $\mu\mu$fd.[1]

These capacity ranges are not to be confused with the capacity of each section, but represent the net capacity obtained when the condenser is employed in the usual split-stator fashion. The

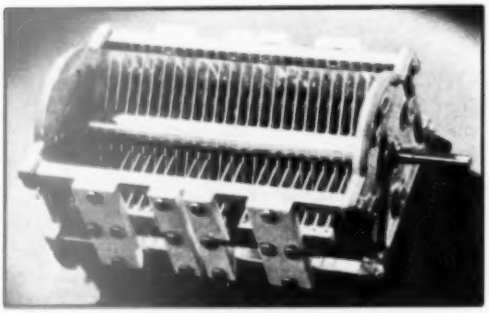


FIG. 2—THE "DOUBLE-SPLIT" CONDENSER DISCUSSED IN THE TEXT

measurements also take into account the effect of the unused sections which are left floating.

The photograph of the sample condenser clearly illustrates what may be termed a revamped 225 $\mu\mu$fd. per section split-stator condenser. The following information should prove helpful to those who may wish to adapt one of their present condensers to this circuit:

The rotor plates are not changed in any way. In order to increase the spacing between the two separate sections of the condenser, one stator plate is removed. In addition to increasing the spacing, this also allows two rotor plates to be employed as the outside plates, forming a more or less effective shield between each of the sections. This decreases the capacity effect between sections, depending on the position of the rotor. As the unused section is left floating, some r.f. current will flow into the plates because of their proximity to the active section; this will increase the minimum capacity slightly, but introduces no particular power loss.

In designing the plug-in coil assembly to be used with this condenser, short leads are readily obtained for the higher frequencies because the two small condenser sections have been located in the center with the two larger sections at each end. As shown in Fig. 1, it is readily possible to vary the length of the coil without having long leads, since it is necessary to employ the entire length of the plug-in coil strip only when the entire capacity of the condenser is to be used.

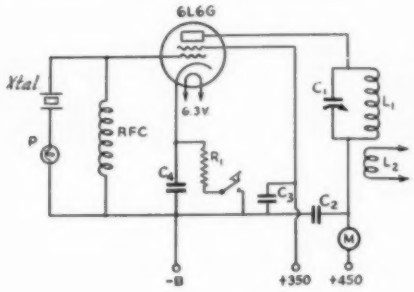
This same setup may be used in the grid circuit, although in many cases it may not be required because a lower *L-C* ratio often may be used without any great sacrifice in efficiency.

This idea will undoubtedly appeal to the high power men who must of necessity use large condensers that present quite a problem when 56- or 28-Mc. operation is contemplated.

Strays

By-Pass Condenser Needed in "QSL Forty" Circuit Diagram

In Fig. 1, the circuit diagram of the 6L6 oscillator in the article "The 'QSL Forty,'" February *QST*, the cathode by-pass condenser, C_4, was inadvertently omitted from the drawing, although



included in the list of parts. This resulted in short-circuiting the cathode resistor and key. The correct diagram, with C_4 in its proper place, is reproduced herewith.

Silent Keys

IT IS with deep regret that we record the passing of these amateurs:

William J. Albert, W6KPU, Whittier, Calif.
J. W. Bush, Jr., W5ZD, Dallas, Texas
Robert H. Cowan, W5EED, El Paso, Texas
T. J. Findley, W6BBN, Los Angeles, Calif.
John B. Goddard, W8AEX, Fayetteville, W. Va.
Fred W. Kinne, W8EOH, Towanda, Penna
William I. Lovett, W7GBJ, Aberdeen, Wash.
B. C. Osborne, W1JZX, Worcester, Mass.
Robert S. Rose, W9DRR, Marquette, Mich.
Samuel R. Smith, W6MNT, Long Beach, Calif.
Bennie Stein, W2ILU, Irvington, N. J.
Raymond J. Taylor, ZL1BA, Auckland, N. Z.
Robert L. Travis, W4CWH, Demarest, Ga.
Anthony G. Wingerter, W9SAT, St. Louis, Mo.

R.F. Interference From Power Circuits

Identifying and Curing Radio Noises

By Robert Y. Chapman,* W1QV

THERE is no doubt that if it were not for noise we all would be able to hear much more DX.

The writer is a firm believer in the old slogan which goes, "let's clean house at home first." So let's talk about the noises that can originate in the operator's establishment. First we must remember that any form of noise external to the receiver is highly-damped r.f. with a peak in some particular frequency region, and when associated with power lines, will be modulated at a frequency depending on the line frequency and voltage involved. Most noise seems to resonate on about 1700 kc. with an average modulation frequency of about 120 cycles on 110-volt lines and about 400 cycles on 2300-volt lines.[1] The easiest forms of noise to locate are the steady buzzes which sound like bumble bees loving a rose.

The major causes of interference originate on the secondary side of the transformer which supplies the affected district. From the reception standpoint, homes can be divided into three classes. The poorest is the type with open wiring and the meter in the attic, plus gas and electric combination fixtures. Let's discuss this type of location from an operating angle.

First, we have no a.c. line shielding, which means that we have open lines to resonate with the output frequency of the transmitter. Regardless of the transmitting frequency we are practically certain of resonance in some part of the wiring. The unmistakable sign is lighting the lights when they are not turned on. The cure is install a small by-pass condenser across the a.c. line at the light fixture.

The most common source of noise in such an installation arises as the result of the light fixtures being grounded to the gas-line fixtures. This arrangement never gives a solid ground and the least vibration results in loud cracks like the snapping of a whip.

Another form of noise results from poor conduction in corroded soldered connections; the greater the load on the circuit the more noise produced. Sounds like a baritone taking a gargle.

If you live in this type of house your chances of causing b.c.l. interference are five times as great as if you lived in a newly-wired house.

The next type is the house having open wiring but with the meter board in the cellar, and having no gas-fixture combinations. The main fault is that when the wiring was done there was no respect for polarity. This installation was in the era of load fuses; they put them all over the house. The fuse blocks get badly tarnished with age; as a result the contact gets poor, and as the load increases heat is generated and the composition boils out and runs all over the connections. This results in a bad noise that sounds like an old '23 Ford throttled down.

Another common source of interference in this type of home is the ceiling fixture having link chain suspension. The only cure is to bond the links. The noise can be identified as a series of snaps with slight buzzes. It must be remembered that in houses with old wiring, bad fixtures and loose connections are almost certain to be found. Also, check the ground connections on all fuse blocks of the type known as "Not-a-fuse". These get loose and cause a bad noise. The water-pipe ground clamp from the a.c. light line also should be inspected.

Next, let's go to the newly-wired homes, complete with BX. Here we do find everything pretty well bonded, but if it is not we are likely to get common a.c. hum interference in the receiver. A prevalent cause of noise in houses wired with BX is the cable chafing against water pipes, resulting in clicks like those caused by keying. This type of interference is often blamed on some innocent ham.

Incidentally, many a buzz can be traced to a wall-socket that has become burned as a result of poorly-fitting lamp plugs.

When you check your home for noise, tighten all loose connections in the fixtures and replace those that are not positive in action—for instance, where you have to snap the switch several times

(*Continued on page 96*)

* 20 Raymond St., New London, Conn.

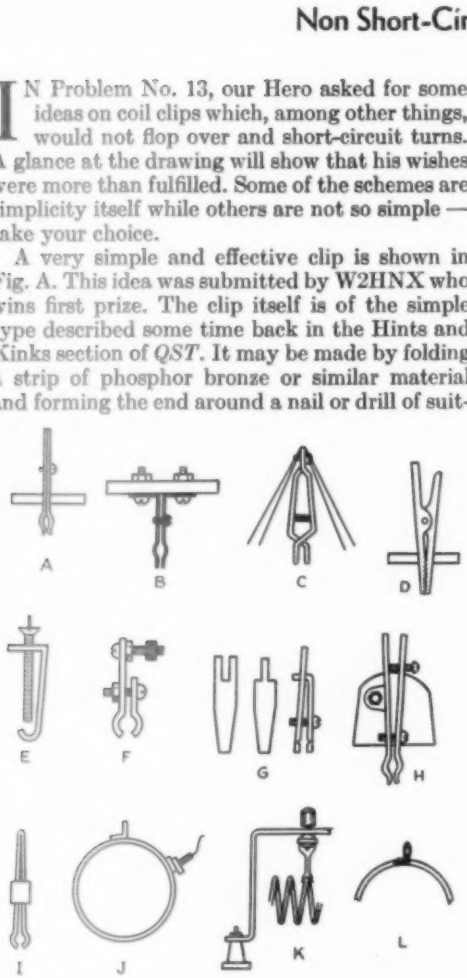
[1] The higher pitch may be associated with three-phase supply or possibly harmonics in the waveform.—*Editor*

How Would You Do It?

Non Short-Circuiting Coil Clips

IN Problem No. 13, our Hero asked for some ideas on coil clips which, among other things, would not flop over and short-circuit turns. A glance at the drawing will show that his wishes were more than fulfilled. Some of the schemes are simplicity itself while others are not so simple — take your choice.

A very simple and effective clip is shown in Fig. A. This idea was submitted by W2HNX who wins first prize. The clip itself is of the simple type described some time back in the Hints and Kinks section of *QST*. It may be made by folding a strip of phosphor bronze or similar material and forming the end around a nail or drill of suitable size. Similar clips are obtainable from certain manufacturers.



To prevent the clip from twisting far enough to short-circuit turns, a hole is drilled about halfway up the clip and a small rod of insulating material such as bakelite or celluloid from a knitting needle is inserted in the hole and cemented fast.

In Fig. B is a somewhat different arrangement utilizing the same principle, suggested by VE4AJQ. The clip, in this case, is made of two pieces of heavy spring brass or phosphor bronze bent at right angles, formed at the ends and fastened with machine screws to a strip of insulating material.

W8QPS uses a "pee-wee" clip of the "bulldog" type with the jaws filed down to permit use on coils with closely-spaced turns. The clip is fitted with celluloid strips as shown at C to prevent tipping too far. The same idea was suggested by W8OWL.

Along the same line is the "alligator" type clip, shown in Fig. D. Each jaw is fitted with a peg of insulating material. The design was submitted by Harold W. Hartman of Los Angeles.

Three types of "pressure" clips are shown in Figs. E, F and G. In each case, sufficiently firm clamping is possible to prevent the clip turning and short-circuiting turns, even when subjected to a strong pull. The design shown at E was submitted by K4EDS. The metal piece is ¼ to ⅜ inch wide. The whole at the top is tapped to accommodate the flat-head machine screw. A small piece of sheet metal is soldered in the screwdriver slot to form a wing-screw which may be turned by hand. Two simple types which require the use of a screwdriver are shown in Figs. F and G. The first was submitted by W2DC and the second, which is designed to prevent any possible twisting while tightening, was suggested by W2BXJ.

In case anyone feels that he must have absolute insurance against twisting, the design of Fig. H by W9SZN should fill the bill. The metal pieces should be cut from stiff brass of as great thickness as practicable. An "ear" is cut as shown on one of the pieces to permit fastening to the small piece of insulation which effectively prevents tipping. The bottom screw should not be tightened completely as it is only a sort of pivot. The clamping action is obtained chiefly by means of the upper screw.

A rather novel clip is suggested by W6GFK and is shown in Fig. I. The clip itself is first formed from a piece of spring brass. A narrow band of soft brass is then bent around the upper part of the clip. Sliding this band up and down on the clip will loosen or tighten the clamping.

Another highly satisfactory tapping arrangement is shown at J. This idea was suggested by W4PL and E. Ottney, Peterboro, Ontario. We believe it merits second prize which goes to W4PL because of his more complete treatment. Its most serious drawback is that it requires soldering, although it has the advantage over all other schemes in that it may be used with coils of very closely-spaced turns. While an ear or tab of No. 12 or 14 wire may be used for the tap, W4PL prefers to file down the head of a No. 6-32 machine screw and also to file out the screwdriver slot to fit the wire and solder the head to the wire at the point where the tap is desired. A standard 'phone tip is just the right size to take a

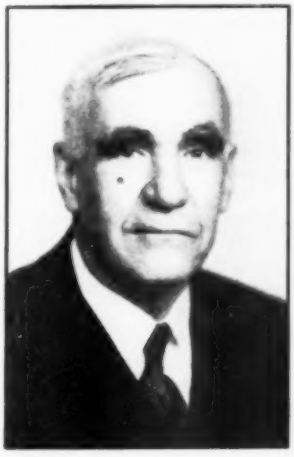
(Continued on page 114)

HAMDOM

AT first glance it may appear an odd thing that this page has not previously presented a word portrait of Dr. Eugene C. Woodruff, the president of the League. After all, Hamdom's most distinguished citizen is surely a personality of interest to amateurs everywhere.

But that is, actually, somewhat a superficial view. This Hamdom page, as it happens, has been primarily a space for facts and figures, where biographical data and vital statistics are condensed into a swiftly-paced pen picture. Dr. Woodruff is not the sort of personality that can be fitted into such compass. His life does not lend itself to being measured with dates and sliced into neatly-packaged sections comprising distinct eras. His philosophy is that of the individualist, and his career reflects that philosophy, and you can't squeeze him into ordinary molds for he just doesn't fit.

It is with the consciousness of considerable temerity, therefore, that we at long last attempt to do this much toward presenting Dr. Woodruff on this page; that we attempt to convey the *feeling* of the kind of man he is. In order that the light and shadow may have a backdrop on which to play this is the skeletal record of his career: Born in St. Clair, Michigan, in 1871, schooled largely at Ann Arbor, graduating a B.Sc. from the University of Michigan there in 1894, followed by a master's degree in chemistry, physics and music in 1896 and a Ph.D. in physics, mathematics and chemistry in 1900, he chose pedagogy as his life work. Invention has been his avocation, or perhaps better, his other life work. He has taught practically every scientific subject in schools and colleges in various locations including Bozeman, Mont., Decatur, Ill., Chicago, and, for the past 25 years, Pennsylvania State College. There he is currently head of the Departments of Electric Railways and Radio, senior classes, and teaches the junior class in general E.E. He is a former athlete and has coached in football, basketball, track and baseball at various institutions. He is a fellow of the American Association for the Advancement of Science and a member in the A.I.E.E. and I.R.E. He belongs to several fraternities and other societies. He was a 1935 medallist for Pi Eta Sigma for scientific attainment.



But to attempt to describe a man in such terms is but to caricature, coldly and lifelessly. The impress of the personality is not gauged by the names and dates. The bloodless symbols of the record book do not vivify the intangibles that are the man; there must be other words to breathe feeling into the portraiture. Dr. Woodruff is a small man, but with a breadth of shoulder befitting an ex-football player of the mauve decade. Sitting or standing—standing he is as comfortable as sitting—he is in repose. There are no meaningless gestures of the hand, no wasted motions. His eyes are bright and deep when he looks at you; but mostly he gazes into the distance as he considers what is said.

His mind is like a complex tool; not a general-purpose tool, but a highly specialized tool, shaped for one purpose only, to perform one function superlatively well. His mind shears off superfluities and retains only essentials. He cannot remember the names of his students, but he knows their features, and identifies them on the mental chart of his classroom which he constantly carries, and he grades the seats rather than the names. He does not forget the grades. At a reunion dinner of old students given him recently he could not recall a name of the forty ex-students present, but he could recall the grade of each and every one.

This is an index. Time was when he could remember the names perfectly well; at Millikan College at Decatur, Ill., and even in the early years at Penn (where he went in 1913) he could remember whole classes, for several years back. But as time went on there were so many names. They became a burden. And they were unimportant; it wasn't the name, but the character, the attitude, the response that mattered. The face was the crux of physical individuality, the grade labelled the mentality. So he remembered the faces and the grades and forgot the names.

Dr. Woodruff is an aloof man, yet a kindly and intimate man. This is the paradox. He is a retiring man, and he shrinks from the light of popular inspection. He is often torn between the

(*Continued on page 108*)

HINTS and KINKS
for the Experimenter

Universal Antenna Coupler

W1CAB has been active in Naval Reserve Communications since 1927, and this made it necessary to have a transmitter capable of working in the 80- and 160-meter bands. Also, like a good many other hams, the urge to hunt for DX is quite strong, necessitating an antenna system that will work fairly well on all bands. Having acquired a new QRA recently, and desiring to keep the antenna system on my own property, I arrived at the conclusion that a 67-foot antenna with Zepp feeders would probably be the best type to use.

For a number of years a Collins network has been a standard piece of apparatus at this station, but with the advent of Zepp feeders it seemed desirable to use the regular series-parallel method of tuning them. Having only the two variable condensers in the Collins network available meant that if they were used for Zepp feeders the Collins network would have to be torn apart.

After a little thought the system shown in Fig. 1, which I have christened a "universal antenna coupler," was devised. Four standoff insulators with banana plug sockets in their ends are mounted in the form of a square about 5 inches on a side (the spacing of these insulators is determined by the length of the coils), and connected as in Fig. 1 (A) with two variable condensers between Nos. 1 and 3 and Nos. 2 and 4 insulators. For the sake of convenience the feeders are marked A and F, A being the one attached to the antenna and F the dead-end feeder. By plugging a coil in sockets 1 and 2 and a shorting bar in sockets 3 and 4 the feeders are parallel tuned, as in (B).

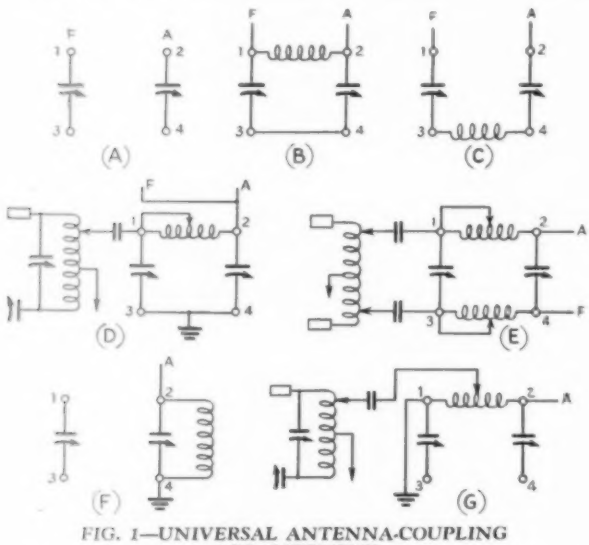


FIG. 1—UNIVERSAL ANTENNA-COUPLING ARRANGEMENT

Using four jack-top stand-offs for connection posts, practically any antenna-coupling system can be used with a few simple changes in plugs. Several representative coupling methods are shown above.

For series tuning, remove the shorting bar from 3 and 4 and plug the coil in these two sockets, as in (C). For Zepp feeder tuning the coil is link-coupled to the final amplifier.

(D) shows the single-ended pi-section network. Place the coil in sockets 1 and 2, connect F and A to 2, ground 3 and 4, and couple the plate tank through a by-pass condenser to socket 1.

By using two coils, as shown in (E) a two-wire line can be coupled to a push-pull amplifier.

When a Marconi antenna is needed the coil may be placed between 2 and 4, 4 being grounded as in (F). An antenna counterpoise system may be used in a like manner by attaching the counterpoise to insulator 4 instead of to ground.

(G) shows a Western Electric antenna coupler that has worked very well on 2000 kc. The coil is untuned and the coupling is varied by tapping down on both the antenna coil and the plate inductance.

This universal coupler has been used quite successfully at station W1CAB for operation on 10 to 160 meters inclusive, and it is hoped that these suggestions will help solve antenna-coupling problems for those who like to work all bands.

—Horace Young, W1CAB

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Band Checker

HERE is a description of a gadget which I have found handy to have around the station. It is the old absorption wavemeter in new form, and consists simply of a cardboard tube from a flash-light cell, on which a coil of No. 22 d.c.c. wire is

wound, with a mica condenser of capacity anywhere between 100 and 250 $\mu\mu$fd. held inside by Duco cement. Pasteboard disks are cemented to the top and bottom of the tube, and a hole is

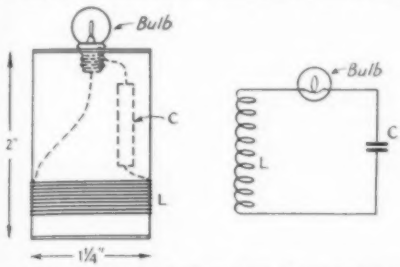

FIG. 2—TUNED-LOOP BAND INDICATOR

Useful for checking the band to which a stage is tuned, also as a neutralizing indicator. C is a midget mica condenser of any convenient capacity, L a coil with turns adjusted to resonate with C at about the middle of a band.

drilled in the top disk for a flashlight bulb, to which wires are soldered. The bulb is held by more cement inside. All three are connected in series, as shown in Fig. 2. The turns are juggled until maximum brilliancy of the bulb is obtained when placed near a transmitter tank operating on the desired frequency. When the correct number of turns has been determined the coil is heavily doped. Final adjustment is made by squeezing the coil together or spreading turns before the dope sets. One can be made for each amateur band used, and also for troublesome harmonics such as 53 meters, 27 meters, etc.

These pickups are considerably more sensitive than the usual loop and flashlight bulb. An indication can be obtained from a low-power transmitter about 7 inches from the tank, using the proper coil. The wrong coils have to be placed almost inside the tank coil before the bulb will light. Likewise, if there is any doubt as to the crystal harmonic to which the tank is tuned, the answer is quickly obtained by holding the indicators near it.

—Theo. J. Mesh, W1CCO

A T.R.F. Stage for the Two-Tube Receiver

THE circuit diagram of Fig. 3, contributed by Adolfo Dominguez, Jr., CM2AD, shows a simple method of constructing a tuned r.f. stage to be used in conjunction with the *QST* two-tube receiver (see recent *Handbooks*). It has been quite successful in increasing selectivity as well as signal strength, and in eliminating the "dead spots" often encountered when the detector is coupled directly to the antenna.

The circuit is arranged so that the detector coils in the receiver need not be rewound. The plate of the 58 r.f. tube is fed through a 2.5-millihenry r.f. choke, and is coupled to the detector grid through C_5, a 50-$\mu\mu$fd. trimmer condenser. The trimmer should be connected close to the detector coil, not more than two or three inches from the coil socket. The trimmer capacity must be adjusted carefully for maximum signal transfer without making the r.f. stage oscillate.

No band-spread is used on the r.f. stage since the tuning is not critical. The grid coils, L_2, are identical with the detector coils except that they are not tapped. The antenna coupling coils, L_1, are wound as described under the diagram. CM2AD's r.f. stage is enclosed in a metal box measuring 4½ by 7 by 6½ inches. A shielding container is of course necessary to avoid oscillation.

The r.f. gain control is useful in preventing overloading of the detector by strong signals, in addition to the other advantages already mentioned.

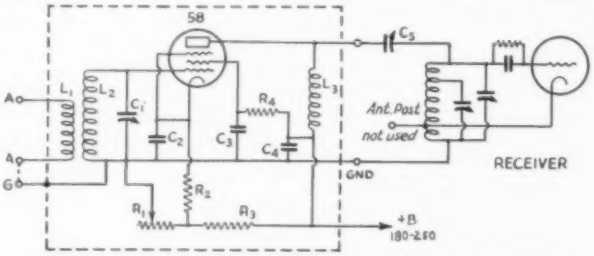

FIG. 3—T.R.F. STAGE FOR THE TWO-TUBE RECEIVER

C_1—100-$\mu\mu$fd. variable.
C_2, C_3, C_4—0.01-μfd. paper.
C_5—50-$\mu\mu$fd. trimmer.
R_1—10,000-ohm potentiometer (r.f. gain control).
R_2—300 ohms, ½-watt.
R_3—50,000 ohms, 2-watt.
R_4—100,000 ohms 1-watt.
L_1, L_2—L_2 same as detector coils in receiver; L_1: 3.5 Mc., 15 turns; 7 Mc., 10 turns; 14 Mc., 5 turns; 28 Mc., 3 turns; all No. 30 d.c.c. wire close-wound at bottom of L_2.

Junk-Box 160-Meter 'Phone for Local QSO's

MOST of us have in our junk boxes parts for which we have very little use. Being among those mentioned, I decided to do something about it. So with pencil and paper and with the thoughts of a simple 160-meter 'phone rig in mind, I started. The rig turned out to be simple, as I had hoped, and was made entirely from the junk box, except for two flashlight cells for the microphone. Not long after going on the air with it I was confronted with "how about the dope on your rig, OM?" and before long these little sets began to sprout locally on the 160-meter band.

The boys say they're FB because excess power isn't needed for local work, more of them can be squeezed in the band with less QRM to ham as well as b.c.l.—and of course the low cost makes them attractive.

The rig here is laid out in breadboard style, although many other ways will prove satisfactory. Little difficulty should be experienced in

getting it "perking," as the circuit, Fig. 4, is almost fool proof. Values, of course, are not absolutely critical. Any satisfactory antenna

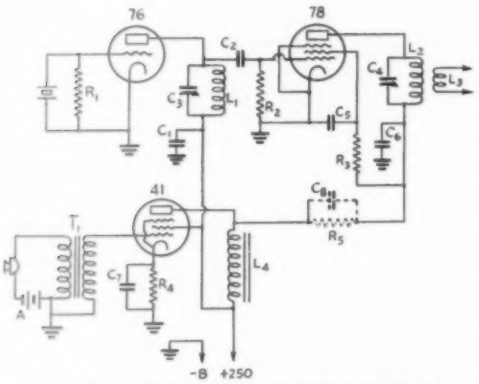

FIG. 4—LOW-POWER 160-METER 'PHONE

C_1—0.002-μfd. mica.
C_2—100-μμfd. mica.
C_3, C_4—100-μfd. variable.
C_5, C_6—0.001-μfd. mica.
C_7—5-μfd., 25-volt electrolytic.
R_1, R_2—50,000 ohms, ½-watt.
R_3—20,000 ohms, 1-watt.
R_4—400 ohms, 2-watt.
L_1, L_2—60 turns No. 24 enamelled on 1½-inch diameter coil form.
L_3—10 turns of No. 24 enamelled on 2-inch diameter tubing.
L_4—30-henry choke.
T_1—S.B. microphone transformer (a bell-ringing or dynamic speaker output transformer will work).
A—3-volt battery.
C_8, R_5—See text. C_8 should be 5 μfd. or more; R_5, 750 ohms, if used.

system will be OK for this outfit, the one here being a revamped 80-meter Zepp, with 25 turns of antenna wire on a 3-inch diameter form in series with the dead feeder and a series antenna condenser in the live one. The antenna coupling coil is wound on a bakelite tube that slides over the tank coil.

The rigs so far have only been in operation a short time and results are starting to speak for themselves. My own, with 1.6 watts input, has worked 75 miles with S7. One of my friends has worked 135 miles with 2.5 watts input.

—Floyd Gribben, VE3LR

On the basis of a 250-volt plate supply, the audio output of the 41 is 3.4 watts when working into a 7600-ohm load. For minimum distortion, the plate and screen input to the 78 amplifier should be adjusted to represent a load of this value. Using 250 volts on the 78, this means that the combined plate and screen current should be 33 ma. Lower current values will increase distortion and lead to overmodulation unless the microphone input is reduced. For 100 per cent modulation the dropping resistor R_5 and by-pass condenser C_8 must be used, in which case the combined plate and screen current should be 30 ma. Under the circumstances this seems a rather unnecessary refinement since the circuit without the dropping resistor will give 90 per cent modulation.—EDITOR.

VE2EE's Freqmeter-Monitor

THE circuit diagram of the freqmeter-monitor described by VE2EE in "Hints and Kinks" in December *QST* showed a connection between the lower end of R_7 and the cathode of the 56 which should not have been there, since it shorts the resistor. Also, the cathode by-pass condenser on the 56, marked "C_3" in the diagram, should have been labeled "C_8."

Several fellows have written in asking about R_4, which appears in the list of parts but not in the diagram. This resistor was originally in the place occupied by L_2, which replaced it, and should be ignored. VE2EE also advises that the 2A7 plate resistor, R_3, will be somewhat better if the value is reduced to 1000 ohms.

The HH4AS Rhombic Antenna

THE angles at the sides of the rhombic antenna shown in Fig. 5 in February "Hints and Kinks" should be 40 degrees. This dimension was not shown in the drawing.

Protection Against Bias Failure

THE following may be of some help to those amateurs using bias packs who would like to protect their amplifiers against bias failure, but cannot afford to buy overload relays.

This system requires an automobile generator cutout, a resistor and one-quarter pound of No. 34 enameled magnet wire. Remove the old windings from the cutout and rewind with the magnet wire. The value of the shunt resistor (R_3 in Fig. 5) can be determined by calculation or experiment. The characteristics of the cutout are such that the contacts will close on 12 ma. and open on 3 ma. approximately. The 3-ma. opening current is the reason for using the shunt resistor, as will be explained later.

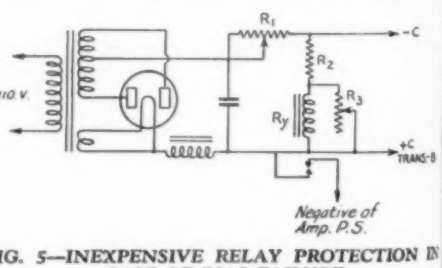

FIG. 5—INEXPENSIVE RELAY PROTECTION IN CASE OF BIAS FAILURE

R_1—15,000 ohms.
R_2—7500 ohms.
R_3—2000-ohm wire-wound potentiometer.

(*Continued on page 116*)

• I. A. R. U. NEWS •

Devoted to the interests and activities of the

INTERNATIONAL AMATEUR RADIO UNION

Headquarters Society: THE AMERICAN RADIO RELAY LEAGUE, West Hartford, Conn.

MEMBER SOCIETIES

American Radio Relay League
Asociatia Amatorilor Romani de Unde Scurte
Associazione Radiotecnica Italiana
Canadian Section A.R.R.L.
Ceskoslovenski Amatéri Vysilaci
Deutscher Amateur Sende-und-Empfangs Dienst
Experimental Radio Society of Egypt
Experimenterende Danske Radioamatorer
Federation des Emetteurs Belges
Irish Radio Transmitters Society
日本アマチュア無線聯盟 Japan
Liga Colombiana de Radio Aficionados
Liga Mexicana de Radio Experimentadores
Magyar Rövidhullámu Amatörök Országos Egyesülete
Nederlandsche Vereeniging voor Internationaal Radioamateurisme
Nederlandsch-Indische Vereeniging Voor Internationaal Radioamateurisme
Newfoundland Amateur Radio Association
New Zealand Association of Radio Transmitters
Norsk Radio Relæ Liga
Oesterreichischer Versuchssenderverband
Polski Zwiasek Krotkofalowcow
Radio Club Venezolano
Radio Society of Great Britain
Rede dos Emissores Portugueses
Reseau des Emetteurs Français
Reseau Luxembourgeois des Amateurs d'Ondes Courtes
South African Radio Relay League
Suomen Radioamatööriliitto r.y.
Sveriges Sandareamatorer
Unión de Radioemisores Españoles
Union Schweiz Kurzwellen Amateure
Wireless Institute of Australia

Conducted by Byron Goodman

Contests:

We mentioned last month that several of the societies are in favor of the proposals by the W.I.A. and the D.A.S.D. to have six large international continental contests each year, under the auspices of one or two of the member-societies of that continent. It can be pointed out that the A.R.R.L., DJDC, and VK/ZL contests almost amount to that now. The idea certainly seems to have merit, and we rather imagine most of the DX men throughout the world are hoping that some such arrangement is made. It should encourage some of the less active countries to be on the air.

Meanwhile, we will list some of the contests planned for 1938. Complete rules will appear in *QST* as they are received from the societies.

During January, the S.A.R.R.L. held its second annual DX contest. This was followed in February by the B.E.R.U. tests of the R.S.G.B., which ran concurrently with the N.A.R.A. contest, and the *Coupe du R.E.F.* and the *Coupe des Pays de Culture Française* of the French society. During March the A.R.R.L. holds its 10th annual contest, the c.w. portion running from March 5–13 and the 'phone portion from March 19–27. On weekends in May the M.R.A.O.E. (Hungary) will hold its contest, and the Polish DX Contest, conducted by the P.Z.K., will run from May 16 to May 30. The Third Annual DJDC Contest will be held during August, with exact rules and times to be announced later. The VK/ZL Contest, conducted this year by the W.I.A. with the assistance of the N.Z.A.R.T., is scheduled for October.

Australia:

By radio via VK2EL we learn of a decided improvement in the amateur regulations in Australia. The W.I.A. has been successful in raising the power limit of VK stations, and they now have a 50-watt maximum power limit without special license instead of the old 25-watt limit. Furthermore, the special licenses for increased power are now good for 24 hours a day, instead of from midnight to 6 A.M. as was formerly the case.

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QSL:

The following correction should be made to the October list of QSL Bureaus:

Luxembourg: Service QSL de Reseau Luxembourgeois, 164 Av. de la Fayencerie, Luxembourg.

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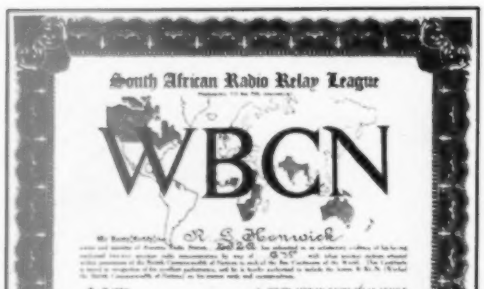
Periodicals:

We don't know if everyone is familiar with the fact that practically all of the member-societies have their own monthly publications. These range from full-size magazines to small mimeographed sheets. However, every one is interesting to other amateurs, and just in case a few of our readers might be interested in amateur radio periodicals of other countries, we are going to review some of them for you. This month we'll talk about the ones written in English.

One of the oldest and most firmly established is the "T & R Bulletin" of the R.S.G.B. The January, 1938, issue (the latest at hand) is a well-organized magazine of 64 pages, printed on

good stock, with several photographic illustrations and a large number of sketches. Technical articles on antennas and receivers, feature articles, book reviews, and a number of departments giving personalized news of both English and British Empire stations round out a balanced issue. The "T & R Bulletin" is issued free of charge to members of the R.S.G.B. The annual membership fee is 12/6 for overseas members (about $3.50); the office is at 53 Victoria Street, London, S.W. 1.

Members of the W.I.A. read "Amateur Radio," a compact magazine of 32 pages (the October, 1937, issue). It contains technical articles on break-in operation and a low-power transmitter,



THE "WORKED BRITISH COMMONWEALTH OF NATIONS"

Certificate offered by the S.A.R.R.L. to members who have worked British Empire stations on each of the five continents (North and South America count as one continent).

announcements of contests, a station description, and divisional notes on the active stations, as well as notes on 28- and 56-Mc. conditions. The editorial address is Box 2611W, G.P.O., Melbourne, and the subscription price is 6/– per annum (about $1.50).

The December issue of "Break-In," the official publication of the N.Z.A.R.T., is a 36-page booklet, printed on good paper with a heavy cover page, with technical articles on series modulation, power amplifiers, parasitic oscillations, and a five-band exciter unit, as well as contest announcements, a station description, personal news and other department articles. There are very few photographs but a number of sketches illustrate the articles adequately. The annual subscription is 7/6 (about $2.00); the address is Box 837, Dunedin.

The first issue (October, 1937) of the "E.R.S.E. Journal," the official publication of the Egyptian society, was the only one at hand. It is mimeographed on letter-size paper, and carries 15 pages. There are technical articles on transformers and 28-Mc. problems, as well as editorial material and personalized news of the members. The subscription rate is P.T.50 per year; address all inquiries to F. H. Pettitt, SU1SG, P. O. Box 254, Cairo, Egypt.

For a number of years the S.A.R.R.L. published "QTC," a monthly magazine that enjoyed an excellent reputation. However, it recently became financially unfeasible to continue with the publication, and the news of the League is now circulated by a monthly mimeographed bulletin of 10 pages or more. It deals mainly with official and social aspects of the League, leaving technical development problems to the foreign amateur magazines that are read also by the membership. Address any inquiries to Box 7028, Johannesburg.

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WAC:

The following WAC certificates were issued during the period from July 1 through December 31, 1937: John B. Power, W3AXU; Kenneth Bryant Warner, W1EH; D. S. Dirden, W6ABE; Z. T. Chang, XU8ZT; Donald Powell, G5MD; Stanislaw Bancer, SP1FU; J. Sroczynski, SP1BR; R. K. Sheargold, G6RS; L. F. Viney, G2VD; C. F. Scruby, G5YU; Jan Simons, ON4AW; D. Jenkins, ZL2SM; J. R. Smith, ZL1JI; F. G. Bell, ZL2SX; J. D. Parminter, ZL2OU; Roger Baffereau, F3LE; A. P. F. Willemse, PK3WI; Cap. Luis Lasaga, XE1AK; Herman Nielsen, OZ9A; Leon Martin, ON4LM; G. A. James, G8CT; T. B. Wimbush, SU2TW; Egil W. Aagaard, LA2X; Richard Utikal, D4OUT; Rolf Tschanter, D4KEJ; C. Florian, YR5CF; G. Wansel, YR5OR; Percy Feng, XU6LN; R. H. Overn, VE3QI; Dan Summers, W6KQH; Sam D. Gross, W1IWC; H. D. Bamford, W1APU; Harry X. Geitz, W2HW; Henry L. Goodloe, W3GAP; Fred W. Watkins, W6FBM; Vernon Dameron, W8HGA; J. P. Jones, W8ASI; William M. Allison, W1FFK; George Robert Stewart (Okla. A & M), W5YJ; Jack C. Shuler, W6KUR; C. S. Hollenbeck, W2BQK; Edward W. Stroetz, W2AEP; Frederick R. Lambrecht, W9YEG; G. C. Giberson, W3PC; *G. C. Giberson, W3PC ('phone);* Theodore R. Jacobs, Jr., W6LHW; *Joe H. Harms, W2JME ('phone); Robert E. Henry, W9ARA ('phone); Ross L. Bateman, W7AO ('phone); Kenneth C. Bryan, K6MVV ('phone); Pedro R. Casellini, LU4BH ('phone); Mario Wallace Simonsen, PY2GJ ('phone); Clement E. de Silvia, VP2CD ('phone); B. B. Bachelder, W6JPW ('phone); Leslie M. DeVoe, W9LQ ('phone); Lucien Champonnois, F3JD ('phone);* Abdoel Rachman Saleh, PK1RA; *G. H. Diesselborg, PK3GD ('phone); J. F. B. Rancwet, PK1ZZ ('phone); H. H. Vrouwes, PK4VR ('phone); Louis Regnier, F3CP ('phone); Maurice Dricq, ON4VU ('phone); Pierre Gibert, F8DW ('phone);* Maurice Harp, W6KJG; *J. G. Lammers, PK1GL ('phone); J. can Eysbergen, PK4DG ('phone);* J. F. Verschuyl, PK1VY; O. A. F. Spindler, VU7FY; George Gathman, W2DOE; Golden W. Fuller, W5FRR; Wm. A. MacKenzie, W1FDN; Thomas Sue Chow, W6MVK; *Pier Luigi Bargellini, 1IKS ('phone);* John C. Wildner, W8NQC; R. C. Schmidt, W9VDY; J. Gilbert Smith, W4AMC; C. E. Asch, W9BIY; Regimental Amateur Radio Station, K5AA; *Larry J. Barton, W6OCH ('phone);* Paul Krelick, W8QQE; Jerome F. Cerny, W9LOJ; Harold S. Dix, W2DPA; Robert L. Poucel, W2AYJ; E. M. Washburn, W3AVJ; P. B. White, Jr., W3FQP; George W. Goodwin, VE2DQ; C. L. Robinson, W6KJV; Robert Engleman, W9OEQ; Jack P. Blindbury, W6AMQ; Winston-Salem Amateur Radio Club, Inc., W4NC; Clyde Kirby, W5FES; Jess Y. Bowman and Jerry Stover, W5YF; John E. Nelson, W6LMZ; Lloyd C. Hoffman, W5JW; J. P. Furrier, W1PZ; *Chas. E. Spitz, W6FZQ ('phone);* Mayo McAllister, W9UQV; A. E. Goldman, W1CSR; Marc Espinel, F8CP; R. P. Freeman, W1ILY; J. G. Zuiderwijk, PA0ZJ; *H. B. Gortz, PA0GN ('phone);* C. H. Ranft, G5RF; *D. A. Richardson, ZS1B ('phone);* H. Haycox, ZS1AV; Rene Jourdan, F8LO; Yasu-

(Continued on page 92)

OPERATING NEWS

Conducted by the Communications Department

F. E. Handy, Communications Manager — **E. L. Battey, Asst. Communications Manager**

THE Maxim Memorial Station building will be progressing rapidly toward completion during March. The equipment for W1AW, according to present plans, will be installed during April and May. Many of the several transmitter units are already completed in the League's workshops. The seven-acre site for the new Headquarters station was purchased by the League last summer after exhaustive studies of the available locations. The Executive Committee in the latter months of 1937 opened a large number of bids on the approved architect's specifications. These details and recommendations were placed before your Board of Directors for examination. With studies and opinions completed, the President authorized the work to proceed; 65-foot masts of western red cedar (five of 'em) were set before cold weather. These provide for several long wire antennas besides which there will be erected a 350-foot per side diamond. Those who receive our field organization "family" bulletins have already noted the news on the project from the date of breaking ground in December to the point of completing the foundation in January 1938.

When completed, the station will have four complete separate transmitters, with full amateur power capability for each amateur band and provision for radiotelephone and radiotelegraph work included for each. It will be a station of which any member may well be proud.

Only four miles from the Headquarters offices of A.R.R.L., the site is in relatively open country adjacent to Hartford, in Newington, Conn. The brick and stone building is large enough to allow later addition of more equipment for frequency "marker transmissions" or other purposes. As we write these lines, we're looking forward to favorable weather that will permit climbing those masts to complete the antenna systems. As you can guess, there are a pile of problems to be solved at every step of a station project. But within the next few months, in May surely, we'll be seeing you via the new W1AW instead of operating on a curtailed schedule in temporary quarters.

Your Board's purpose has been to rehabilitate your station washed out in the 1936 floods (W1MK) and at the same time set up a fine, suitable, and lasting memorial, to keep alive indefinitely the memory and inspiration of the League's First President. W1AW (H.P.M.'s old call), in lieu of W1MK, will soon be ready to carry on the duties and program of your A.R.R.L. stations. This advance information is in response to many inquiries from members on the progress. It will be encouraging to know that the rafters are up and the work on the radio end is well advanced.

Copying Bee participation was up 52.7 per cent, according to reports on that December activity, with interest near the all-time high! In late March those who took part will be getting back their individual reports to enable comparison with the transmitted material. Full results will appear in the next issue of *QST*, or the following issue.

On Harmonic Interference: It is timely to suggest that all amateurs look into adjustment of transmitters and re-check them carefully! In accordance with the regulations (Par. 381) amateur transmitters must be "as free from harmonics as the state of the art permits" . . . and that is today a very low value of harmonic intensity indeed.

One S.C.M. writes, "It's time for another warning to 75-meter 'phone members about their second harmonics falling at about 7900 kcs. Heard at least 15 yesterday. QSOed several and advised them of the dangers. One was S9. I listened to him on 7958 (!) and transmitted on 3925." From another, "Telephone harmonics have completely washed out our Corps Area net frequency of 3725 kcs. at times, and the Signal Office advises me that amateurs throwing an unnecessarily strong harmonic on this frequency should be reported to the F.C.C. Can't you treat this matter in *QST*? Trouble also on Trunk G (3625 kc.) frequency, but unable to identify them yet." The R.C.A.C. office in Washington report some difficulties with c.w. band harmonics from 3.5 Mc. likewise and amateur radiograms are being filed to notify offenders and request remedies in the speediest possible fashion.

We suggest that effort be made to clear these adjustments up, to avoid citations and F.C.C. trouble for individuals and in line with the high standards of the amateur service which has a splendid record of coöperation in giving immediate attention to such things. Improperly high grid bias and excessive plate voltage, high modula-

tion transients, and coupling to antennas of harmonic energy generated by such things is often the source of trouble. Local listening, tests with other amateurs, and careful analysis of transmitter outputs should *always* prove profitable . . . to all amateurs. Get the energy into your antenna on the *desired* frequency, operate tubes on the proper sections of their characteristic curves and get better tube life and results!

—F. E. H.

PRIZES FOR BEST ARTICLE

The article by Mr. I. L. Tilden, M.D., K6PGQ, wins the C.D. article contest prize this month. Each month we print the most interesting and valuable article received marked "for the C.D. contest." Contributions may be on any phase of amateur operating or communication activity (DX, 'phone, traffic, rag-chewing, clubs, fraternalism, etc.) which adds constructively to amateur organization work. Prize winners may select a 1938 bound *Handbook*, *QST* Binder and League Emblem, six logs, eight pads radiogram blanks DX, Map and three pads, or any other combination of A.R.R.L. supplies of equivalent value. Try your luck. Send your contribution to-day!

"I Don't Want QSL from W's"

By I. L. Tilden, K6PGQ*

SOMETIME ago I happened to run across this statement following the call of a prominent station in the Western Hemisphere—"I don't want QSL's from W's." My interest was immediately aroused.

I call to mind a very good friend of mine, a boy permanently crippled by infantile paralysis. Born and raised in the heart of Chicago's great west side, he found, not only a fascinating hobby, but a means of livelihood in amateur radio.

I will always remember my first visit to his station. Surrounded by two- and three-story tenement houses, with the roar of the elevated in my ears, I was ushered into his small, second-story backroom. Upon the wall were framed membership certificates in the A.R.R.L., Rag Chewers' Club, and Chair Warmers Club. His Class A license was displayed in a prominent place on the wall.

And then he showed me the pride and joy of his life, a homemade C.W. rig, made up breadboard style of second hand parts with a pair of tens in the final, yet electrically sound in every principle. Last but not least, we spent a pleasant hour going over his QSL cards which were carefully indexed alphabetically, according to station and district, and kept in a box file. His greatest DX was a W6 and he had never worked outside the United States and Canada. His twenty-five-foot antenna (the best that he could manage under the circumstances) was hemmed in by power lines.

Several weeks later he managed to contact K5AA. This QSO was the big topic of conversation on our daily six o'clock schedule for weeks following and I'm sure he considers that K5 card (which arrived in due course) as one of his most valuable possessions. This Canal Zone station with its many operators has had a soft place in my heart from that time on.

To digress a little: I one morning heard a station outside the United States calling CQ DX. I was able to contact him and the only thing he could say was QSL. I sent my card at once but am still waiting for his. The same thing has happened on numerous occasions. It seems that many foreign stations do not care to work W's, especially W9's. And if contact is established, they cut the QSO as short as possible and are reluctant to QSL, although most of them promise to very faithfully. While in the W9 district, I could call CQ and listen in vain for an answer. Here in the K6 district with the same rig and a much less efficient antenna, I can call CQ and take my pick of W's, VK's, ZL's and an occasional K7, J, XE, etc.

So pity the poor W and especially the W9. (There are so many of them.) If you XE's, PY's, LU's, K7's, K7's, K6's, VK's and ZL's hear a weak, wavery signal coming from W9, please remember that it may be emanating from the shack of one such as my friend (and there are hundreds like him). Give him a break and by all means QSL. It is a small thing to do and you may rest assured that your card will occupy the place of honor on the wall of his shack. Though you may be tired of W cards and perhaps regard the practice of exchanging cards as a pernicious habit, still, it is done by the majority of amateurs, and, especially to one just starting out, is a big part of the game. It seems to me that you would gain more lasting pleasure from your hobby if you would make it a point to work some of these W's who are starved for DX. What may be an everyday occurrence to you is usually a rare event to them.

"I don't want QSL's from W's." Just a bare statement of fact, and yet it calls to my mind the story of hundreds of chaps such as my friend, scattered throughout the great cities and farms of the middle west, to whom a foreign card would mean a great deal. To me it is not in keeping with the spirit of amateur radio.

EDITOR'S NOTE.—The thought behind this article might well be carried further—to the exchange of QSL's between W's. The majority of U.S. amateurs enjoy receiving QSL's from other W's. Although they may not confirm DX contacts, they convey the same spirit of fraternalism. Perhaps the chap you QSO'd is working for W.A.S. He will need your QSL card for this purpose. But QSL cards are not merely a confirmation of contact—they are a symbol of the true amateur spirit . . . they provide welcome mementos through the passing years of pleasant associations with brother amateurs, whether those amateurs happen to be located in Timbuctoo or "next door."

* Queens Hospital, Honolulu, T. H.

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Oregon Emergency Service

Radio amateurs of Astoria, Oregon, banded together at the headquarters of the local N.C.R. unit, provided communications for that city when a storm in the Northwestern portion of the country destroyed regular wire facilities in late December, 1937. Under the leadership of Ensign Prewitt, W7AGP, N.C.R. unit commander, efficient service was rendered without a let-up for nearly two whole days and nights.

W7BDR at the key of W7GKP, the Astoria N.C.R. station, made contact through a Portland amateur with the N.C.R. personnel in that city and N7ATP in Portland was on the job. The Seattle N.C.R. station and individual N.C.R. members throughout Washington were also standing by to assist. W7BBO's transmitter was brought to the Astoria headquarters and BBO and W7ALM had it going in little better than an hour (coils had to be wound for the correct frequency, etc.). As radiograms piled up W7EBQ took the surplus traffic to his station and put it on the A.A.R.S. networks. Most of the Oregon A.A.R.S. members were on the air, as well as several Washington members and numerous non-members so W7EBQ had no trouble in keeping his hook clear. Among those active were W7BGM, DDZ, WR, BLN, FNO, ABB, FVK, EOY, FLF and WY. At N.C.R. headquarters activity went steadily forward. W7CBA took another batch of the surplus traffic to his station and moved it via 1.75-Mc. 'phone. Regular Navy operators from NPE took a postman's holiday, taking tricks at W7GKP after standing their regular watches at NPE. The National Guard kept a supply of hot coffee always ready for the operators. Wire service was partially restored in about two days, although amateurs remained ready to service for the remainder of a week due to danger of floods and slides. It was a job well done—in orderly, efficient fashion.

Briefs

Radio amateur members of the employees club of the San Joaquin Light and Power Corporation have banded together in the interests of their hobby. They have a station in Fresno, California, operating under the call W6HYG. Two nets are maintained, one on 1866-kc. 'phone, one on 3732-kc. c.w. Members of the group are W6OBT FNK LDZ BKC KOB MHU LQU AHL NFW LBZ QK LMW JDU CVL IYL DXG EAE DT OHI PLI. An independent power source is being planned for the Fresno control station (W6HYG) to improve emergency facilities.

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A hook-up consisting of W9YPX, Isle Royale, Mich., W9BBN, Grand Marais, Minn., W9DOQ, Duluth, Minn. and W9DCM, Minneapolis was functioning on December 31st, ready to render whatever service was needed in the worst storm that section of the country had seen for some thirty years. The circuit brought news of the safety of Isle Royale residents and reports on flood conditions and damage at Grand Marais. Ice covered all communication and power lines but the wind let up before more serious damage could be done.

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With wire communication disrupted by a severe sleet storm on New Year's Eve a family at Gillsrock, Wisconsin, obtained a doctor's advice for its sick baby by amateur radio. W9GIS at Gillsrock made contact with W9JM at Sturgeon Bay. The latter communicated with the physician, received instructions and sent them back to W9GIS.

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Jammed into Times Square, New York City, engaged in the New Year's Eve celebration, W5BTX was surprised by a lusty CQ from a tin horn at his elbow. The natural inquiry, "Say, bud, are you a ham?" brought the reply, "Sure, 2HN—who are you?" . . . and thus started a QSO amid the bedlam of the occasion.

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Due to the fast work of amateur radio, VE1EB, who is Division Supt. of Government Telegraphs, was able to complete the installation of cable between Grand Manan Island, Bay of Fundy, and the mainland before winter arrived in earnest. His order for submarine cable, two miles of it, weighing about ten tons, had been delayed in shipment. As weather conditions were getting worse daily no time could be lost. VE1EB went to the shack of VE1IE at Castalia on Grand Manan and succeeded in contacting VE1BF, St. John. Ascertaining that the cable would be in St. John the following morning, arrangements were made by VE1BF for shipment by Diesel freighter the following night. The cable arrived at the island none too soon, but in time to enable the installation to be completed on the last suitable day of the season.

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On December 28, 1937, due to a sudden moderation in temperature in Western Canada, numerous and severe snowslides in the Rocky Mountain district resulted in disruption of wire communications. The C.P. and C.N. Railways each had but one line from Toronto to Vancouver and amateur radio was called upon to assist with the traffic load. A group of 14-Mc. 'phones provided communication from morning until late afternoon when wire service was restored. Stations cooperating were VE3IX and VE3EO, Toronto; VE3AHA, Dryden; VE4TM, Calgary, Alta.; VE4NI, Winnipeg, Man.; VE4BD, Biggar, Sask.; VE5CR, Vancouver, B. C. Every message handled was checked back to the sender, making a 100% efficient circuit.

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Traffic for OX2QY, the MacGregor Arctic Expedition, Reindeer Point, Greenland, is routed via A.A.R.S. nets as follows. From WLM/W3CXL, the Washington control station, messages go to WLNF/W2BCX, Elizabeth, N. J., on 3497.5-kc. W2BCX then shifts to 14 Mc. and relays to W2BCR, Newburgh, N. Y. at 6:00 P.M. EST each night. W2BCR jumps into his car and drives to W2CIF, about four miles away. W2CIF has a 14-Mc. beam directed towards OX2QY with a good 1 kw. of power. Schedules are kept nightly between W2CIF and OX2QY at 7:30 P.M. EST, or as soon as OX2QY clears his commercial traffic with WCC. OX2QY uses 14,368-kc. and also schedules W8CJJ.

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W2FF handled a rush message for N. Y. C. from VO3X, originating at the Grenfell Mission and concerning breakdown of a heating plant there. VO3X stood by while W2FF delivered the message and received a reply, which concerned precautions necessary in repairing the boiler to insure safety. The complete message exchange took only twenty minutes.

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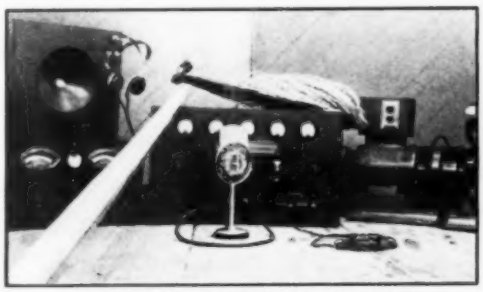
South Carolina 'Phone Net

South Carolina has a "160 meter" 'phone net operating on 1960-kc. each Sunday at 8:30 A.M. EST. W4EOZ is Net Control Station. Divided into four divisions, Northwestern, Central, Eastern and Southern, the net includes W4EJK, W4ETC, W4EZF, W4DKB, W4EOO, W4EGH, W4CHD, W4ETF W4DQY (OPS), W4EOZ, W4BNN, W4BGD, W4EHF, W4DPN, W4CUS and W4FAL. W4EOZ calls the division control stations and receives report on all stations present, then any traffic coming through is handled, being relayed to stations in the most advantageous locations. Control stations maintain schedules with W4DVZ, North Carolina, W4OX, Georgia and W4DOG, Florida, as outlet stations. A number of the net members also operate 28 Mc. 'phone and relay distant traffic on that band.



A DE LUXE EMERGENCY LAYOUT

This is station KINT, complete in every detail and ready for emergency service, including 50-watt transmitter, receiver, gas-driven a.c. power plant, collapsible dural antenna masts, and all associate gear. KINT is one of the several stations in the emergency network of the Los Angeles County Flood Control District. Maurice E. Kennedy, W6KQ, is radio engineer for this network, which comprises both fixed and portable stations. The key station is KIIY, located in down-town Los Angeles; 2726 kc. is used for voice work, with a special frequency of 3190 kc. for c.w. operation from the small stations when they cannot be received on voice during the daytime.

W8KJ feels that more careful identification should be made by operators on the ultra-high frequencies. Not only should the call be clearly identified but mention of location would also be helpful.

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A new city ordinance in Detroit, Mich., requires that any device or machine which causes interference to radio reception, or to transmission of any program broadcast by radio, must be corrected by suitable filters, shielding, etc., or the use of said device or machine must be discontinued. This ordinance is not directed against radio transmitters and does not affect transmitting radio amateurs or other F.C.C.-licensed stations. Detroit listeners (amateurs and BCL's alike) who are troubled by man-made interference can obtain relief by notifying the Supervisor of Radio, Detroit Police Department.

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O.B.S.

The following is a supplement to the list of A.R.R.L. Official Broadcasting Stations in October *QST* (page 50): W2HZL, W4DQY, W4DSY, W5BN, W5ECE, W5EST, W5KC, W7GLH, W8BOK, W8IHN, W8JRL, W8NEU, W9EC, W9OXC.

BRASS POUNDERS' LEAGUE

(December 16th–January 15th)

Call	Orig.	Del.	Rel.	Extra Del. Credit	Total
K6OCL	693	288	1397	132	2510
W4PL	11	39	2302	25	2377
W8HCS	246	370	1244	260	2120
W6IOX	33	77	1744	70	1924
W2BCX	11	19	1573	—	1603
W1IP	21	20	1194	11	1246
W8QAN	155	54	984	28	1221
W5MN	110	230	610	143	1093
W8LSF	72	54	882	28	1036
W7EBQ	43	102	784	43	972
W3CIZ	64	237	431	227	959
W4CXY	62	66	770	40	938
W3QP	115	386	2	384	887
W8OFO	23	21	774	62	880
W9ESA	91	237	424	113	865
W7FVK	17	34	766	19	836
W3SN	53	128	641	—	822
W9RMN	21	47	707	36	811
W3BWT	159	148	382	85	774
W4NG	33	104	634	—	771
W1AKS	94	112	520	41	767
W8KWA	7	75	657	—	739
W1AXB	30	27	662	8	727
W9BAZ	40	61	582	36	719
W5CEZ	58	98	543	15	714
W1UE	161	286	128	130	705
W1IOT	49	113	521	19	702
W2GGE	9	19	640	15	683
W6LBB	87	123	356	114	680
W8CLL	38	24	610	—	672
W6ZM	50	155	306	155	666
W9AZR	30	28	588	7	653
W6LUJ	64	205	180	202	651
W4HK	45	20	566	18	649
W8PLA	119	82	400	48	649
W3CHH	7	10	616	6	639
W6BMC	5	12	609	9	635
W6MGL	7	21	583	19	630
W9RWS	36	26	550	13	625
W5EOE	26	41	536	21	624
W1IHI	62	129	409	16	616
W5DNE	102	93	370	48	613
W3EML	60	78	389	78	605
W1IWC	71	117	396	19	603
K6ONF	125	223	178	45	571
W6JTV	58	164	182	152	556
W1AFB	17	55	442	37	551
W1EMG	34	48	424	38	544
W9ZJS	105	87	294	41	527
W6LMD	3	13	502	7	525
W6KFC	52	365	63	41	521
W9OUD	51	60	389	20	520
W6COH	18	30	448	23	519
W2GVZ	57	130	212	119	518
W5DXA	36	63	392	20	511
W9NFL	20	25	453	12	510
W4AXP	—	—	508	—	508
W1JCK	25	78	342	60	505
W9PTU	21	85	384	15	505

MORE-THAN-ONE-OPERATOR STATIONS

Call	Orig.	Del.	Rel.	Extra Del. Credit	Total
W5OW	259	184	1030	134	1607
K5AA	821	172	34	129	1156
W9BNT	82	341	630	22	1075
K6NXD	581	125	71	—	777
W1GOJ	40	80	571	51	742
W3CXL	46	21	522	—	589
W5FPO	125	98	154	154	531
W5FSK	55	52	380	33	520
W4AWO	18	57	374	53	502

These stations "make" the B.P.L. with *total* of 500 or over. One hundred deliveries + Ex. Del. Credits also rate B.P.L. standing. The following one-operator stations make the B.P.L. on deliveries. Deliveries count!

W9PLL, 274	W5FDR, 174	W6NQB, 128
W9KJY, 269	W2DBQ, 169	W3AKB, 123
W2OQ, 264	W9HPG, 157	W1IOR, 121
W6MQM, 263	W1KH, 150	W6JAT, 109
W8CEU, 218	W4DVO, 148	W8JQE, 109
W6IMI, 213	W5BN, 137	W1JMY, 106
W2HOZ, 209	W3DGC, 135	W6FQU, 106
W8GUF, 206	W2JHB, 132	W7FZB, 105
W9EDQ, 201	W5AOZ, 131	W2PF, 103
W6ITH*, 194	W1BFT, 128	W7HD, 103

A.A.R.S.

Call	Orig.	Del.	Rel.	Extra Del Credit	Total
WLMI (W6GXM)	127	285	1356	257	2025
WLR (W41R)	27	205	1000	164	1369
WLMM (W7NH)	7	21	694	2	724
WLMG (W4NG)	26	43	444	—	513

WLVV (W6KDI) made the B.P.L. *on 132 deliveries.*

MORE-THAN-ONE-OPERATOR STATIONS

Call	Orig.	Del.	Rel.	Extra Del. Credit	Total
WLM (W3CXL)	398	323	3819	167	4707

* All traffic handled by two-way radiotelephone.

Michigan Emergency

DURING the afternoon of December 31st a steady rain was freezing as it fell. By nightfall all wires had a coating of ice at least one inch in diameter. W8FTW was so advised. Because of acquaintance with the operators at WPV, the Detroit Edison Co.'s radio station, it was decided that this was the best place to get information on ice conditions in the district. The Port Huron District Supervisor of this company has offices in the same building as the radio station, so through this office and the telephone switchboard in the radio station, the following conditions were determined: (1) Several high-voltage transmission lines were down in the Thumb district. (2) There was no wire communication with towns to the North. (3) The power company was not very concerned about the breakdown at 11 P.M., December 31st.

W8JKO and W8DPE got together at 12:55 P.M., January 1st, and immediately a broadcast was put on the air clearing all channels for emergency. The 1.75, 3.5 and 7-Mc. bands were monitored for any possible weak signal from any amateur who might be trying to get out. W8BRS and W8NIV worked together; while one operated the station on 3.5 Mc., the other monitored the 1.75-Mc. band. An amateur in Deckerville, Mich., one of the stricken points, did his best to inform the public as to conditions. W8DPE contacted the W. U. Traffic Department and found that they had several messages they would gladly turn over to radio, if a reliable contact could be made. W8NIV and W8CSX were immediately notified of this. While W8JKO, W8BRS and W8DYH were attempting to get through, W8CSX received a personal call from W8GHP of Pigeon, Mich., which is located in the stricken area. When informed of the need of his station he immediately left for home, arriving around 2 A.M. Upon his arrival he immediately contacted W8CSX and made a schedule for the next morning.

At 9:30 A.M. on January 2nd. W8DPE was informed that a direct contact had been made with the stricken area through W8GHP. Western Union filed a number of messages with amateur radio. W8DPE took this traffic to W8CSX and assisted him in getting it through to W8GHP. After W8GHP had cleared the traffic he drove two miles into Pigeon and contacted the Western Union Manager at Bad Axe over the only 'phone line working, and succeeded in getting the messages to him for delivery.

On the afternoon of January 1st, W8IM reported that the power company desired to get in touch with its Bad Axe, Mich., power house very badly. He considered taking a portable rig up there. W8JKO notified the members of the 3663-kc. A.A.R.S.-A.R.R.L. Net. This net then established contact with both 3.9 and 1.75-Mc. 'phone stations. W8IBH and W8JKO gathered together a portable transmitter and genemotor power supply, together with a battery-operated receiver, and prepared to go to Bad Axe. However, they were advised that the State Police had forbidden travel on the highways, and that the Detroit Edison had decided against sending any portable. So W8JKO returned to 3663 kc. and advised W8FTW, who had taken over control, that we were not going. The fact that W8BUD had been contacted in Bad Axe also figures in abandoning our early plans. About 7 P.M. January 1st, we were notified that the Detroit Edison now had telephone contact with Bad Axe and that the Western Union wires were back in service. W8FTW was notified and he transmitted the information to the net. Some traffic was originated for the power company and the set-up was capable of handling more.

W8DPE (S.C.M.) and W8JKO

Briefs

Alphabetical QSO's are the latest in the coincidence line. At 1:50 A.M., one morning, W6NRE signed off with W6IWY on 1.75-Mc. 'phone. One minute later he was in contact with W6JWY.

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Frank Chiron Spoon, K7GLD, at Shegong Creek, Alaska, is believed to be the first Eskimo amateur. He maintains several schedules and is reported as being an FB operator.

Code Practice

W9NNA, Terre Haute, Indiana, is transmitting code lessons throughout February, daily except Saturday and Sunday from 6:30 to 7:30 P.M. CST on 1875-kc. W8LCN, Wheeling, W. Va., announces code practice transmissions on 1756-kc. each Thursday at 8:30 P.M. EST. W1ASD, Hartford, Conn., announces change in schedule of code lesson transmissions to 7:30 P.M. EST, Monday, Tuesday and Friday on 1882-kc. The schedules announced by W9ZDZ in February *QST* have been discontinued.

Station WRTD, Richmond, Va., 1500-kc., broadcasts a code class each Thursday from 6:45 to 7:00 P.M. EST with W3AMB as instructor.

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An attempt to "use" New Orleans amateurs in an illegal manner did not prove profitable to the proponents of the idea. Due to the fact that amateurs respect their regulations and value their rights the "racketeers" involved shortly found themselves in jail. The scheme was to station a man at a point of vantage near the race track, from which point the winning horse could be seen. The second the winner crossed the finish line this information was to be 'phoned to an amateur station and then sent by radio to six listening stations in New York State, where bets were to be placed on the winning horse before the official news could be flashed by wire. W5FMO and W5FPO were offered $50.00 to $75.00 a day for the use of their stations, but refused and notified the Radio Inspector, who placed the matter in the hands of the police.

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A.A.R.S. Speed Contest

Complete details on A.A.R.S. members' participation in the December, 1937, A.A.R.S. Speed Contest appear elsewhere in this issue. Among the non-A.A.R.S. members participating in the contest the following made the highest ratings in each Corps Area: First C.A.—W1UE 45 w.p.m., W1TS 40 w.p.m. Second C.A.—W2CJI 40 w.p.m., W2KBM 35 w.p.m. Third C.A.—W8OKS 40 w.p.m., W3CRS 40 w.p.m. Fourth C.A.—W4BIH 40 w.p.m., W4EBA 35 w.p.m. Fifth C.A.—W8BKM 45 w.p.m., W8KQE 20 w.p.m. Sixth C.A.—W9HUM 65 w.p.m. (with best report submitted by anyone), W9RLB 40 w.p.m. Seventh C.A.—W9CMF 35 w.p.m., W7FRV-9 35 w.p.m. Eighth C.A.—None submitted. Ninth C.A.—W6MUR 40 w.p.m., W7CRH 40 w.p.m. The only Canadian report was from VE3HP, 30 w.p.m. In the case of those having equal speeds within any C.A., they are listed in order according to the length of copy made accurately at those speeds.

Letters of commendation from A.R.R.L. President Woodruff to the highest scoring eligible member League in each Corps Area have been awarded to W1BVR, W2BCX, W3AKB, W4AFQ, W8BKM, W9NGS, W9HUM, W5BMI, W5GEY and W6GXM.

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Amateur radio was represented at the Hobby Show in Augusta, Maine, October 25 and 26, 1937, by a very impressive exhibit. Two complete stations were set up, one a 50-watt 'phone on 1.75 Mc., the other a 300-watt rig on 3.5-Mc. c.w. No antennas were used on the transmitters since they worked with W1BE, the N.C.R. station located directly over the auditorium where the show was held. A sizeable total of messages was handled, being relayed to W1BE. Most of the traffic went from W1BE to W1BIG, who maintained a schedule with W1IP for connection to the A.R.R.L. Trunk Line system. Credit for the success of the exhibit goes to W1BWR, W1BE, W1BIG, W1KCO, W1JOA, W1EFA and W1BUH, all of whom coöperated in the preparation and booth maintenance.

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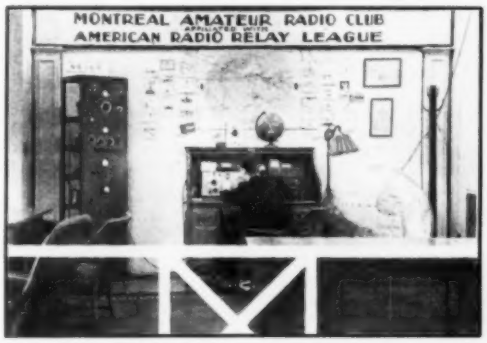
While QSO with W9IAG, Peoria, Ill., on November 6, 1937, W5FSH mentioned the fact that he had a brother living somewhere in Peoria from whom he had not heard for over four years. The following Saturday contact was again established with W9IAG, and W5FSH was very happily surprised to hear his brother's voice over the ether. Thus two brothers were reunited after a long separation, thanks to amateur coöperation.

Here's a cross-band contact that was made against the will of the participants. W2HRN had just completed a 6L6 oscillator and was trying 3.5 Mc. for the first time, using a 3617-kc. crystal. Hearing W2KMS call CQ near his frequency, he gave him a call. KMS came back with an RST 579x report, much to HRN's satisfaction. KMS' signals were 569x. HRN went on to explain that this was his first QSO on 3.5 Mc., whereupon KMS inquired what frequency HRN is using. It developed that KMS was listening to HRN on 7 Mc., and KMS thought his transmitter was putting out on 7 Mc.! We think the simplest way out of the dilemma would have been for the lads to swap transmitters! But there's a sadder ending to this little story. HRN figured that if he were getting out so well on 7 Mc. with the rig working as a straight 3.5-Mc. oscillator, he should get out much better if he were to double, so he made the necessary adjustments, closed the key and blam! . . . broke his crystal into four pieces. "No more eighty meter experimenting for me," says W2HRN, "I'm going back to forty and stay there."



The Montreal Amateur Radio Club's booth at the "Produced in Canada Exhibition," November, 1937, is a lesson in good planning and execution. The M.A.R.C. and Les Amateurs Canadiens-Francais de la TSF combined their efforts in representing amateur radio at the Exhibition. Each club installed a separate station so that dependable communication for demonstration purposes could be maintained between the two stations in event conditions were not favorable for outside contacts. VE2JY loaned his station for the L.A.C.F. booth, while the entire shack of VE2EE, Quebec S.C.M., was transported to the Exhibition as the M.A.R.C. exhibit. The usual messages were handled and various members of the public were permitted to "talk on the air." Ham parts were on display as well as numerous signs (out of view of the camera) regarding messages being accepted, the object of amateur radio clubs, etc. Amateur radio was given added prestige in the Montreal area due to the efforts of the two clubs.

Hams Afloat

W7FTL is aboard the U.S.S. *Tatnuck*, NETQ . . . W4BYS is Sparks on the Tug *Cadmus*, WQBL . . . W4CPL is on the S.S. *Colorado* . . . Chief on the S.S. *Seminole*, WNCX, is W1CDF . . . W1FOH operates WHCB, S.S. *Brazos* . . . W1FBX is on S.S. *Osage*, KJTQ . . . The rigs on the S.S. *Shawnee*, WOBG, are a 500-watt Spark and 50-watt tube set—i.c.w.; W1UW is Chief, W1JOB second opr., W4EBK third opr . . . W8CLL was on the Tug *Sulphite*, KENQ, on the Great Lakes for the third consecutive year . . . W1IMS is third mate on the freighter S.S. *Tillian*, out of N. Y. C. . . . W9OV is operator on S.S. *Padnay*, KUGQ, plying between New York and about twenty ports in Western Africa . . . W9AUQ is third operator, S.S. *Excambion*, New York and Mediterranean Sea ports . . . W9ETB is third opr. on S.S. *American Banker*, New York and London . . . W6HSG is operator on WLFF, a fishing boat out of San Diego.

—•••—

VE3LY is reputed to be the only ham in the world who has worked all four members of the "Caveney Family": VE3GG VE3KH, VE3BB and VE3ADZ.

How's DX?

How:

The month of March may mean various things to various kinds of people, but to a ham it means only one thing: the DX Contest! And since you people have been so kind in helping out this column with your reports and tips, we felt that we would like to tell you how to win the contest. We aren't kidding when we say that you'll surely get somewhere if you follow our suggestions, but we aren't saying where you'll get. . . .

First of all, you'll want an electric razor. After seeing some of the advertisements, we're sure that it will be just the thing to use, shaving while you're pounding brass with the other hand. Connect the razor across the primary of your plate transformer so it will shut off when you turn off the transmitter, or else you will QRM yourself. If the ads are right, you can even wear your dinner jacket, but this is no real advantage from a radio standpoint.

However, with your well-groomed appearance (and possibly the dinner jacket) your YF or mother should have no objections to serving all of your meals at the operating table. It's really amazing how her attitude will change as long as you remain neat and tidy, and you'll gain time by having all of those meals at the table. Be honest: can you sit through a whole meal at the dinner table when you just *know* that you're missing some prime DX? Of course you can't.

Another good trick is to build up a beautiful friendship with a doctor and then get him to testify that the reason you didn't show up at the office that week was because you were very sick. In this way you won't lose a week's pay, and it will help to explain the black circles under your eyes on Monday morning.

However, from the operating standpoint, there is one very simple way to beat your competitors, and that is to score more points. This can be done in a number of ways, but we can't tell you now because there's a man come to see us. A strong man, in a gray uniform. . . .

Where:

That 7-Mc. gang really kicked through this month, and a couple of the best-looking ones are reported on 40. W3ATR reports contacts with LX1AS (7142 kc.) at around 4:30 P.M., and FO8AA (7135 kc.) at 3:30 A.M. .. .. .. Someone may be kidding us, but W4BRB reports FU2X (7040 kc., T3) as an officer in the French Foreign Legion. QSL via F3BX .. .. .. W8DPY reports FQ8AB (14,255 kc.) as a fellow who doesn't like to be called slowly but at about 25 w.p.m. He tunes from the middle towards the high end .. .. .. Many are wondering about the authenticity of I7AA, ex-I7EY (14,410 kc. T9), at Addis Ababa, Ethiopia. He's OK, and your card can be sent care of the Italian QSL Bureau .. .. .. For the 'phone men, W5FIY recommends VR2FR (14,145 kc.) at around 6:30 A.M., CST .. .. .. J2JJ (14,300 kc., T9) tells us to look for VR4AD (14,260 kc.) and VQ5A (14,370 kc.) .. .. .. ZB2A (14,270 kc., T9) reported by many, and supposedly in Gibraltar, is quite possibly a phoney. At any rate, the RSGB knows nothing about him, and they're supposed to be forwarding his cards. According to G6WY, it is very difficult to get permission to operate a ham station in Gibraltar. "Ham" also tells us about EA9AI, CR6AF, PX2A and SV6SP (Crete), all on 7 Mc. .. .. .. W5GKZ says to get on 10 if you want Guatemala: TG9AA (28,450 kc., 'phone) .. .. .. HR1UZ will be on again soon, on 40 with a pair of 204A's. He says VP4AA (7025 kc., T9) is the station of the British Guiana Expedition, in the Amazon River valley about 1000 miles south of Georgetown .. .. .. YN1AA (14,405 kc., T8) says you can save yourself money by not sending him U. S. stamps or international reply coupons. The U. S. postage is of course n.g. and the postoffice does not honor the reply coupons. He has about $5.00 worth of the latter right now .. .. .. There has been quite an influx of "phoneys" the past month or so. Some of them, like B4UP, B2A, and the like, make no pretense and freely admit that they are aboard a ship somewhere. Incidentally, B4UP told us the other day that he's retiring soon, after 5 years of brass-pounding on the seven seas. But the guys that are in our hair are ones like the fellow somewhere around Washington, D. C., who was signing YI2RJ on 20, or the youngster in Richmond, Va., who has been signing OX2ZA, HR5AK and K6DEN, on 20. We also learn that VR2AB and VQ1AB were phoneys. We hope these smarties will be sporting enough to stay out of the DX Contest and not waste everyone's time .. .. .. They don't all get away with it. The fellow who used TF1A for a while has been turned over to the F.C.C.

When:

That 3.5-Mc. band we have is turning out to be OK as far as DX goes. W9LEZ worked ZL1DI, D4ORT (3515 kc.), and a number of K7's .. .. .. W7FPN worked ZL1DI (3625 kc.) and ZL2TP, and heard ZL3IN (3670 kc.), ZL2FG, and ZL2FR (3625 kc.); and W7FBK worked ZL1DI, ZL2TP, and ZL1HQ .. .. .. W8PWU heard ZL1DI, ZL2FR and ZL4AF (3600 kc.) around 5 A.M. and has worked G6WY (3545 kc., T9). Europeans heard there include G6HB, G6RB, D4GAD, HB9C, HB9U, HB9AA, HB9AS, HB9BG, HB9CK and ON4AU, between 3500 and 3650 kc. .. .. .. W3EPD worked D4ORT and HB9AS (3525 kc.), and W8KWA got ON4AU and G6RB .. .. .. W1ZL worked 16 countries on the band last winter with 25 watts to a 6L6G oscillator, and bids fair to surpass the performance this time. Most consistent so far are G6WY, D3FVI, HB9AS, G2ZP and G6RB (worked 8 times) ..... The 75-meter 'phones boom in over there according to G80G and ON4HS, and they remind us that most of the Europeans are not allowed to operate as high as 3900 kc. They suggest that the W 'phones look around once in a while for some of the DX that hears them.

It almost appears that the 7-Mc. bunch is ganging up on

W2GTZ SPECIALIZES IN ASIAN CONTACTS

Reeve Strock, W2GTZ, is an old-timer in ham radio. He started in 1913 with a spark coil and the call 9UY, and ended up with W2GTZ and a pair of 46's in 1932. The present rig uses either crystal or ECO, and ends up with a pair of T200's in the final, feeding either a 2- or ½-wavelength Zepp. The ½-wave Zepp slants, and is used for Asia mostly, the longer wire filling-in in the other directions. A sked with VK6SA has been kept for over a year with only 2 misses, and Reeve made 114 Asian contacts last year, which isn't too bad for a W2.

this column and trying to force us to eat our belittling words about their band. All of which is OK with us, and our only comment is "Have at it, men" .. .. .. Besides the ones we mentioned, W3ATR has worked ZB1P (7035 kc.), OK1CX (7025 kc.) HA2L (7070 kc.), HB5G (7060 kc.) and many others. Heard were PZ1RL (7015 kc.), CT1QJ (7190 kc.), LU1AB (7105 kc.), PY2CQ (7165 kc.), OZ9NH (7085 kc.), YR5EV (7080 kc.), HK5JD (7095 kc.), and others .. .. .. W3BGD, a club-mate of W3ATR's, worked LU5AN (7045 kc.), ZS1CX (7015 kc. T7), and ON4HC (7020 kc.) one night between 10 and 12 .. .. .. W4BRB worked VP7NC (7180 kc. T9x), VP7NL (7130 kc., T6), VP7NR (anywhere, T9c), YV1AK (7030 kc., T9x), YV4AX (7225 kc., T9x) and VK6SA (7030 kc., T9x) .. .. .. W9AIC knocked off F3KH (7035 kc.), OK2PN (7045 kc.), D4NXR (7030 kc.), HK5JD, ZL1LZ, ZL1BR, VK3CW and many more, while W9KJX has worked ZB1P, and W9HQH has raised OK1BC (7295 kc., T9) and D4ATT (7325 kc. T7) .. .. .. Up in Canada, VE3ALM helps us out by listing LU4BH (7185 kc.), PY2HH (7180 kc.), SM6UJ (7150 kc.), VO1D, VO1M and VO1W (7070 kc.), and HR4AF, and in the low end of the band, YS1FM, VS7AG!, HH2LD, and YV5AA on 'phone. This at what VE3ALM claims is the noisiest QRA there is .. .. .. W8DPY worked CN1CR (now CN1AA) on 40, about the middle of the band .. .. .. Another W9 who must be reckoned with is W9WCE, who worked XE, YV, K6 and ZL, and sends in a long list of stations heard, including OE3AH, F3KH, GM8AT, G2PL, HK3AL, K6, ZL and VK .. .. .. Count on the W6's, of course. W6CIS reports G2PL (7050 kc.), ON4AU (7000 kc., T8); J2NF, J8CG and J2KJ all at 7150 kc., and OK1BC (7280 kc., T9), also reported by W6KUT .. .. .. Up north a ways W7ENW knocks off HA2L, OK1BC, PAOAC, VP1DM, YV2MS and VK's .. .. .. W8QHL contributes FA8BG (7145 kc., T9), OK2JR (7165 kc., T9), HC1FG (7145 kc., T8x), and many of those previously mentioned. He says Europeans from 9 P.M.–2 A.M., K6's after 11 P.M., ZL's after 2:30 A.M., and DX good up to 7 A.M. These can all be stretched out a bit, with Europeans breaking through in late afternoon .. .. .. W2HZS is no piker either when it comes to finding the good ones. His include FA8PM (7110 kc.), VP5CK (7055 kc.), VP6TR (7040 kc.), LU5BL (7115 kc.), and F3AM (7200 kc.), but Bob still needs a "G"! .. .. .. If you still aren't convinced about 40, W2FJH tells about SP1MF (7100 kc.), LA6K (7100 kc.), OZ1B, SM5MZ, I1EC and SP1IA; W2DIJ reports working 20 countries on 40 during evenings the past two months; W2GMM worked PAOPN with a 47 xtal oscillator; and W2IOP reports J3FJ at 7120 kc. .. .. .. Taking all the evidence into consideration, it simply appears that the 40-meter gang has been too taciturn, and there is plenty of DX kicking around all the time. So let's hear about it.

The VU's as well as other Asians have been fairly consistent on 20 in the east lately. Some of the better ones worked at W1TS include VU2LK (14,010 kc., T9), VU2EO (14,060 kc., T9), VS6AG (14,055 kc., T9), UK8IA (14,300 kc., T7) and U9AW (14,410 kc., T8). XZ2DY (14,100 kc., T9) and U8IB (14,440 kc., T8) were heard at 7:45 A.M. .. .. .. W8LZK manages to squeeze plenty of DX out of the band between T.L. schedules on 80, and worked ST6KR (14,160 kc., T9x), KA1AF (14,140 kc., T9x), ZS3F (14,080 kc., T8x), U5OL (13,395 kc., T9x), CR7AW (14,300 kc., T9x), VU2AN (14,060 kc., T9x) in Baluchistan, VS6AG (14,050 kc., T9x), and VQ8AS, VQ8AE, VQ8AB. Some of those heard include U6WB (14,400 kc., T8), VS7RF (14,340 kc., T9x), VS2AE (14,030 kc., T9), XU8AM (14,090 kc., T9), VQ4CHS (14,035 kc., T9), VQ3TOM (13,395 kc., T6), and VQ4CRI (14,150 kc., T7) .. .. .. Another U6 to look for is U6ST (14,350 kc., T8) .. .. .. W2HHF still sneaks in some good ones, the latest including I7AA, CR7AY (14,030 kc., T9), and XU8RL (14,330 kc., T9). Among those heard: VQ4KTC (14,360 kc., T8), UX5AE (14,410 kc., T9), FB8AA (14,130 kc., T8c), and ZE1JV (14,280 kc., T9) .. .. .. Latest at W7ENW include ZT5V, ZS2F, ZS2X, ZU1T, ZU5AQ, SU1WM, ES5D, PY2KX, UK1CC, PAOAZ, D4NRF and others .. .. .. J2KX (14,340 kc.), J2OV (14,340 kc.), ZB1R (14,430 kc.), and U9AV (14,425 kc.) have been coming through in W9, according to W9AIC .. .. .. W3ZX doesn't let much get past him. His latest include U5AH (14,420 kc., T7), U1AD (14,415 kc., T9), CN8MS (14,410 kc., T6), CN8AR (14,290 kc., T7), CN8AX (14,400 kc., T7), SU5NK (14,300 kc., T9x), PK1RI (14,360 kc., T9) and VP1JR (14,410 kc., T8) .. .. .. W3GAU reports VP3TEV (14,430 kc., T9). QSL via VP3BG. Incidentally, the VP3's fist is hard to read, and the boys are still arguing whether his call is 3TEV or 3TEST. At least he doesn't have to go to "swing school"! .. .. .. Just in time to make this issue, W2CYS drops in with KA1QL (14,366 kc., T9), VS6AO (14,340 kc., T9), and G8DO (14,300 kc., T9) in the Channel Islands. Heard was ZD7H (14,390 kc., T9) in St. Helena. Jeeves, warm up transmitter No. 7 and swing the beam to 75° east of south!

Reports on 28 Mc. are practically nil this month but we feel that it is because there is nothing really startling coming through, with the exception of one or two mentioned above. However, the band is in good condition, as evidenced by a long list submitted by W3AKX. The list includes stuff in five continents and some nice ones like HR5C, SV1CA, CE2BE, HJ4EA and a raft of Europeans and K6's. Ten will probably be pretty hot during the Contest.

W7EVN, CASPER, WYOMING, HOLDS W.A.S. TICKET NO. 271

All but three states were worked on 3.5 Mc. Rhode Island, Nevada and Vermont were snagged on 7 Mc. Transmitter uses a '47 crystal, '46 doubler, P.P. '10's final, running at 60 watts input. W7EVN is also an enthusiastic R.C.C. member.

Nothing much of DX contacts on 5, but the boys are still at it. CM7AB has xtal down there, on 57,600 kc., and will be looking for W's .. .. .. W2KRB is on in the mornings looking for Europeans, and is anxious to arrange test schedules.

What:

W9JZJ brings up a topic that may bear a little discussing. It is this business of the fellows with the rotatable "beams" on 10 and 20, and whether or not they are worth the effort. The average gain is usually not more than one or two "S" points, and ordinarily that won't make much difference. Remember, this is the gain over a straight antenna, not the front-to-back ratio. The front-to-back difference is of course quite useful for both sending and receiving, reducing QRM considerably in many instances. But if the intent is to extend your operating time and work stations when no one else can, you'll probably need a fixed array with its greater gain. Or don't you agree?

Who:

W6ITH ran into a 'phone signal on 14,120 kc. the other evening, and the operator had a marked Oxford accent. "Ah," says Reg, "a G." When the fellow signed it was J2NG, in Tokyo. Reg raised him and found that the accent had been acquired during seven years of school in Australia .. .. .. The first WAS in Argentina will go to LU7AZ if he gets a card from the New Mexico station he worked the other day .. .. .. Maybe you've wondered about these stations in Hejas and Bahrein, and why they don't seem to

answer many calls. A letter from De Mont Stevens, at Jedda says that he is on the air for a mining company with three 30FXC transmitters, but you're wasting your time if you call him when you hear him testing. The Arabian government only licenses them if their transmissions are confined to within the country. Woe is us! .. .. .. OA4AB, well-known 'phone, is back in the States and will be signing a W2 call soon .. .. .. W6JMR now has 457 different Europeans to his credit, including 185 different G's. And incidentally, he has worked G2YL, J2IX, HC1FG, VE5YL and K6MZK—all he needs is an African YL for a YL WAC .. .. .. Some nice work at W6KUT includes contacts with YN2AB, HC1PZ, YV1AK and YS2AB, bringing his total to 77 countries .. .. .. With his usual nonchalance, W9KG tells us that he has completed WAC on 40 with stuff like U9AV, J2MO, HR4AF, YS1FM, ZS1CX, HK5JD, a flock of LU's, and Europeans including ES, I, EA2, and HB. The 14-Mc. list is a mile long, and includes VU2FX at 9 P.M., VQ4CHS, OQ5AE, VS7MB, YV4AX, CN1CR, KA1AX and HI2T. Keat still has a "Missouri KW" of 95 watts to a pair of T2O's, and an even 100 countries .. .. .. HK1Z is now HK5AR .. .. .. W2IXY keeps a 'phone sked with VU2CQ three times a week, and says she didn't sked VP3THE as erroneously reported here, but did sked OX2QY .. .. .. The other morning W8JSU hauled up to 40 and worked GM8AT, daylight all the way. He spent the day 100 miles away, pulled back in the evening, got on 20 and his first contact was GM8AT, darkness all the way. It looks like he needs a new receiver and the advice that 40 is a darkness band and 20 a daylight band, or something .. .. .. W9HQH worked U9ML (14,435 kc., T9c) for WAC at his new QTH .. .. .. A welcome report from W5VV tells of his latest, such things as TF2C (14,290 kc., T7), ZE1JZ (14,400 kc., T9), VU2EO (14,380 kc., T9), VQ8AS (14,125 kc., T9), FR8VX (14,440 kc., T9), I7AA and others. His total is 107 countries worked, with only 68 confirmed. The thing has reached the point where he is practically off the air—in an effort to raise money to buy postage to send letters to get those delinquent cards Wilmer has sold most of his transmitting gear!

.. .. .. Here's another new one, reported by W3CBT: ZM4AD (28,190 kc., 'phone) in British Samoa. Boyd also worked TG9AA .. .. ..

.. .. .. Some of the W1's have decided to enter the contest after all. Yes, W1FH, that perennial threat, *should* be out of this year's contest. Wedding bells ring Feb. 27th, and to our congratulations and best wishes we add a sigh for another good man gone wrong .. .. ..

Here's hoping all youse guys have a grand time in the Contest. Personally, we're going fishing—for a few new countries!

—*W1JPE*

A.R.R.L. Headquarters Operators

Hal Bubb, "Hal," Chief Opr. W1AW.

The following calls and personal sines belong to members of the A.R.R.L. Headquarters gang:

W1AL, J. J. Lamb, "jim"
W1AW, A.R.R.L. Headquarters Operators Club
W1BAW, R. B. Beaudin, "rb"
W1BDI, F. E. Handy, "fh"
W1CBD, C. B. DeSoto, "de"
W1DF, George Grammer, "gg"
W1EH, K. B. Warner, "ken"
W1ES, A. A. Hebert, "ah"
W1GS, F. C. Beekley, "beek"
W1JBJ, Thomas W. York, "tom"
W1JEQ, Vernon Chambers, "vc"
W1JFN, A. L. Budlong, "bud"
W1JPE, Byron Goodman, "by"
W1JTD, Hal Bubb, "hal"
W1SZ, C. C. Rodimon, "rod"
W1TS, Don Mix, "don"
W1UE, E. L. Battey, "ev"
W5CJB-1, Thomas M. Ferrill, Jr.

DX Century Club

CENTURY CLUB membership now totals fifteen, W6GRL and W8DFH having recently received their certificates. Congratulations to these new members! "Ham" Whyte, G6WY, is back at the top of the list with a healthy lead. W8CRA has a good grasp on second place. A number of the "under 100" group are moving rapidly towards the century mark, W9KG having only three more to go. We look for several new club members within the next few months.

Check over your confirmations in accordance with the January *QST* list of countries and send them in as soon as you can present 75-or-more. When sending your confirmations, please accompany them with a list of claimed countries and stations representing each country to aid in checking and for future reference after your confirmations have been returned to you. Please send postage to cover the return of your confirmations.

MEMBERS, DX CENTURY CLUB

	Countries
H. A. Maxwell Whyte, G6WY	126
Frank Lucas, W8CRA	119
Jefferson Borden IV, W1TW	114
Douglas H. Borden, W1BUX	114
John Hunter, G2ZQ	114
Henry Y. Sasaki, W6CXW	108
Clark C. Rodimon, W1SZ	106
Harry G. Burnett, W1LZ	106
Don H. Mix, W1TS	105
Walton H. Bostwick, W2GW	105
Reeve O. Strock, W2GTZ	102
Jean Lips, HB9J	102
C. E. Stuart, W6GRL	102
Guy Grossin, F8RJ	100
E. L. Walker, W8DFH	100

The following have submitted proof of contacts with 75-or-more Countries:

W9KG ..	97	W3EVW ..	88	W1JPE ...	82
EI5F	96	W6ADP ..	87	W1RY ...	82
W9PST ..	95	W8OQF ..	87	W8EUY ..	82
W8LEC .	94	W6GAL ..	86	W2CYS ..	81
W8JMP .	93	G2DZ	86	W4CCH ..	80
W8OSL ..	93	W2GVZ ..	86	W3EPR ..	79
W9EF ...	92	W4DRD ..	85	W4CFD ..	79
W1WV ..	92	W1DUK ..	84	W3EVT ..	78
W1DF ...	90	W2HHF ..	84	W8ADG ..	77
W9ADN .	90	W3JM	84	W8BSF ..	77
W9KA ...	90	W8KKG ..	84	W3AIU ..	77
W1ZI	89	VE2EE ...	83	W4AJX ...	76
W6FZL ..	88	G5QY	83	W6BAM ..	75
W3BES ..	87	G5RV	83	W9UM ...	75

Delaware

For the information of those searching for a Delaware contact for W.A.S., we print a list of Delaware stations: W3SL HC WJ DQ AIS AIW AKH AOP ARM BBP BAK BTQ CPG CIY CHJ CLU CER CWF DIA DKO DMO DMP DNC DNF DNH DNI DNN DNP DOA DOH DPA DQG DRD DRE DSQ DTD DTK DUA DUK EGN EGV EIH EIX EJA EJU EEB EPT EYM FLA FNI FFF GCO FGW FHK FJK FKI FKT FUO FUW FVX GAU GEN GFD GGQ GGW GVQ GYQ GZH HBE HBR HDA HF MA DTO DZF.

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W2KGN points out that QRK? means, "Do you receive me well? Are my signals good?" . . . This does not necessarily call for an RST report. QRK? can well be used during long QSO's to check occasionally on whether the other fellow is receiving you OK. QRK (without the question mark) means, "I receive you well. Your signals are good." W2KGN suggests RST? when we desire an actual signal report.

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W2SB worked UPOL, the Russian North Pole Expedition, on November 3, 1937, 8:52 to 9:10 P.M. EST. The expedition's frequency was around 13,990–14,000 kcs., c.w. W2FSN made contact immediately following W2SB.

Station Activities on page 100

CORRESPONDENCE

The Publishers of QST assume no responsibility for statements made herein by correspondents

"The Amateur Is Progressive"

251 Lafayette Ave., Grantwood, N. J.

Editor, *QST:*

I agree heartily with your reply to the letter by W2GTW in your February issue. When I read such letters it makes me wonder just what some of these boys are getting out of their hobby. If the old adage, "You only get out of a thing what you put into it," holds true in these cases, they certainly can't be getting much. Luckily for them, however, A.R.R.L. is putting in enough to make up for their failure to do so. They spend their time worrying about losing a kilocycle and criticizing the activities of the League, which has made possible the comparatively large number of kilocycles that we now have, without doing anything themselves to warrant the use of same. I hate to think just how many kilocycles we would now enjoy if all amateurs had been, and were now, as selfishly non-progressive as such letters indicate.

The third rule of the amateur's code is, "The Amateur Is Progressive." This should mean, I believe, not only that the amateur should keep his station abreast of science but also that he should keep himself abreast of the times by digestion of as much of the knowledge of the science as is practical, and by as much personal experimentation as his finances will permit. Where would the amateur be now if he had taken such an attitude toward 'phone in the pre-'phone days as this writer (W2GTW) takes toward television?

I believe that I have as much authority as W2GTW and a much more scientific attitude when I say that most amateurs are heartily in favor of the "publicity" on television as well as articles on model airplane control by radio. The amateur will never lose a kilocycle through his aid in the development of television, but he is very apt to lose several if he fails to keep up the good work of technical advance. The advancement of the science and aid in communication emergencies are the only excuse for the amateur's being. Lacking these, the amateur must gradually give way to more pressing services. With these, he will last indefinitely and need waste no time by worrying over a lost kilocycle.

—*H. G. McCann, Jr., W2KWK, ex-W1KAM*

Vote of Thanks

85 Overland Ave., Bridgeport, Conn.

Editor, *QST:*

I wonder how many of us realize the swell job being done for us by our QSL bureaus throughout the country.

If all the rest do their volunteered duty as well as our W1BGY, I sincerely believe we all owe each and every one of them a hearty vote of thanks.

We can all do a small part to help our respective district bureau by seeing that he has one of our stamped, self-addressed envelopes in his office, that he may attempt to keep his files up to date.

You might say, "I do not work any DX; there are no cards for me." But don't forget, there may be a few "heard" cards for you.

Nothing brings quite as much happiness and enthusiasm to the "non-DXer" as a heard card from some remote country.

So fellows, let's get behind our local QSL bureaus and send them some envelopes and take advantage of this really fine service.

—*Charles A. Taylor, W1DOV*

Maybe It Was Two Other Fellows

14 Britton St., Jersey City, N. J.

Editor, *QST:*

. . . It is not very unusual for stations to work each other on schedule using their second harmonic, but when a harmonic and an image frequency come into the picture through the medium of QSO's then you have something. The 160-meter c.w. band is dead enough at night, but in the afternoon hours it is even deader than dead. However, I used to operate there quite a bit. One day I heard a CQ going on and decided to call the fellow. I got him and he turned out to be a fellow cityite living a little more than a mile away. As I have said, we had about twenty chats when one night he decided to drop over and carry on a ragchew in person. Well, our conversation led us to learn that all the time he was transmitting and receiving on 80-meter c.w. and I, at the same time, was transmitting and receiving on 160 c.w. It turns out that he was copying my harmonic and I was getting his image frequency. Neither had any knowledge of this, and at no time did we make a schedule. When one heard the other calling

a CQ he gave him a shout. At all times the signals were R99 plus at both ends. . . .

—Charles M. O'Brien, W2EQS/W3DPY

They Do Work

16 Windsor Road, Somerville, Mass

Editor, *QST:*

Who says that directional "CQ's" do not produce results?

While QSO with ZS2A this afternoon on 14 mc. he asked me to QSP three messages concerning schedules, particularly on 28 mc. to W9DXX, W6JJU, and W7AMX. At my consent, the messages wiggled off ZS2A's "bug" in one—two—three order.

After a short rag-chew we signed off, and I tackled the job of delivering the messages immediately, so that the schedules proposed therein might be kept by the recipients. Starting up the transmitter (the buffer being used as the output stage with only 165 watts input) I tried a directional "CQ" as follows: CQ CQ CQ CQ tfc de ZS2A for W9DXX W6JJU W7AMX de W1LZ W1LZ W1LZ. This was repeated three times and then the receiver was turned on again. Imagine the glow of satisfaction when back came W9DXX. "Alice" took her message solid the first time through the nerve-wracking racket of a parked truck's motor. Who says that the "YL's" cannot show the "OM's" how to operate?

A bit more of rag-chewing with W9DXX, and the other two messages were tackled. A CQ similar to the first one brought no results. Then I remembered that the transmitter was on 14,008 kc. Since both W6JJU and W7AMX are usually to be found on the other end of the band, the transmitter was shifted to 14,388 kc. Listening on this end of the band neither of the desired stations could be heard, so I decided to try another directional CQ. Back to the receiver after this CQ, and W7FH was heard on the edge of the band coming back to me. He took the message with no "fills" and advised me that W7AMX himself was calling me on my own frequency. Tuning a bit further into the band, W7AMX was located. During the three-way QSO that followed W6JJU's message was easily forwarded with assurances of an immediate QSP by W7AMX. . . .

—Harry G. Burnett, W1LZ

120 Mc. for Beginners

724 West 44th St. Terrace, Kansas City, Mo.

Editor, *QST:*

The Tulsa Amateur Radio Club in the January, 1937, issue suggested a method of bringing unlicensed 5-meter operators within the law and aiding prospective amateurs in learning the code by issuing a special short term license to permit operation on this band.

I doubt if the 5-meter operators would be willing to compete with the hundreds of additional inexperienced operators whose noisy transceivers would add to the congestion on the already crowded 5-meter band.

If this proposed class were assigned to still higher frequencies, for instance above the 112- to 120-Mc. band, they would not interfere with 5- or 2½-meter work and would at the same time promote investigation of these unexplored bands.

The following plan is a modification of the one submitted by the Tulsa Amateur Radio Club:

1. The exam should be easy, consisting of questions on ultra-high-frequency theory, transmitters, antennas and on amateur procedure as well as knowledge of the code including numerals and some punctuation marks.

2. The term of the license should be no more than one year during which period the operator would be required to pass the Class B exam or forfeit amateur privileges until he does.

3. The band should extend from 120 to 130 Mc. With further development of equipment even higher frequencies could be used.

4. Only c.w. (types A-1 and A-2 emission) should be permitted with 100 watts maximum power since the purpose is to enable the operator to learn the code—not DX.

5. The call could be designated by four numerals, the first being the number of the call area.

Even with low power and directional antennas distances of 10 miles or more could be worked. Perhaps "bootleggers" would be reluctant to leave 5 meters but radio clubs would be much more willing to report "bootleggers" if they could go to the higher frequency band.

Perhaps modifications of this and the other plan would be acceptable to the A.R.R.L. and the F.C.C. if enough support were given it. It would be valuable in training future hams and would aid greatly in cleaning up the 5-meter band and stimulate interest and investigation of frequencies above 60 Mc. . . .

—John C. Dodds

DX Test Technique

Tarboro, North Carolina

Editor, *QST:*

. . . The proper way to work DX is to listen and then call the station with which contact is desired. If this simple method is carried out I feel certain that the station seeking DX will realize several times the benefits of his station when using this method as by trying to call the DX to him.

. . . Unless conditions change considerably from what they have in the last two months it will be necessary that the above method be followed (in the International Tests. —Ed.) DX has been very, very scarce in this part of the United States during this period. What with the ever increasing number of stations the openings in the band are forever dwindling. After several QSO's within a radius of one thousand miles nearly every amateur tells me that he, like myself, isn't making any contacts with DX stations. So, fellows, when March rolls around let's all have a chance at the DX by listening and not clutter up the band by useless "CQ DX" calls.

—J. M. Carstarphen, Jr., W4CCH

World Peace and World Friendship

730 N. 6th St., Grand Junction, Colo.

Editor, *QST:*

That letter "Hams and Peace," by W8QN, on page 52 of June *QST*, with its accusation that hams were doing nothing at all to further the cause of peace, would rather make it appear that the W.F.S.R.A. has been lying down on the job as far as advertising itself is concerned. . . . We have been coming along lately, now having members in 15 countries and 4 continents, and expect to go WAC in membership shortly. In England things have been going even better than here, and there are now more members of the W.F.S.R.A. in England than there are in the United States, much as I blush to have to admit it. In England Mr. Arthur H. Bird, G6AQ, is in charge of W.F.S.R.A. affairs, with the title of Hon. Secretary for Great Britain and Ireland. His QRA is 35 Bellwood Road, Waverley Park, Nunhead, London, S. E. 15. I am still the world secretary, but G6AQ acts in all matters relating to W.F.S.R.A. affairs in the British Isles.

You probably recall the requirements of membership from the item on page 74 of July, 1935, *QST*. The rules are still just the same: It is necessary simply to copy and sign the pledge and forward to me (or to G6AQ, for G members). . . .

The W.F.S.R.A. is doing something to promote peace, W8QN to the contrary notwithstanding! I am enclosing a copy of the Membership Pledge, in case you wish to quote it.

—Duane Magill, W9DQD

Editor's Note.—The pledge: "I hereby promise that I will, to the best of my ability, make such use of my amateur station as will be conducive to international friendships; that I will never voluntarily permit my station to be used as the tool of selfish nationalistic interests; and that I will do what I can, as a radio amateur and as an individual, to promote world peace and understanding."

(*Continued on page* 122)

One of the large radio tube manufacturers recently went on record with the statement that radio tubes had a longer period of service with the filaments always hot than when they were shut off when not in use. The principal reason given for this was that the temperature strains caused by alternate heating and cooling were the most common cause of tube failure. For instance, these strains may lead to strange secondary effects such as leakage from cathode to filament, due to rubbing when parts expand and contract. On the other hand filaments are not harmed by running hot with plate current off and may even have their emitting qualities improved.

This is in line with our own experience. It certainly agrees with the experience of the commercials, many of whom have their HRO's turned on all the time. They do this not so much to save the tubes, however, as to simplify remote control and operating procedure. For instance, some of the airlines have their HRO's located a mile or so from the operating position, where they operate on fixed frequency, unattended. Once thoroughly warmed up the temperature drift of an HRO is negligible, so that by operating with filament power always on no adjustment of the tuning control is necessary. This simplifies remote control to the ultimate degree, for there is no "control," just a stable receiver with an off-on switch in the B-supply lead.

Amateurs do not operate on fixed frequency of course, but it seems to us that this idea of continuous tube heater operation has a number of advantages for the amateur. In addition to long tube life and very high frequency stability, there is the further advantage that the set is always ready to operate with full efficiency at a moment's notice. During DX contests or other heavy schedules this technique is particularly worth while. The power consumption is not an important consideration. At W1HRX (where the power is now per KWH and not per gallon of gasoline, thanks to the new pole line) the rate is about 3½ cents. On this basis filament power for an HRO is about $7.25 for a full year, twenty-four hours a day, every day. This is also the approximate life of a set of tubes when operated as described above.

Of course, where the set is operated only occasionally, it is hardly worth while to leave the power on. Also, not all sets are designed for continuous duty, and our suggestions above are not a blanket recommendation. All National receivers can be operated continuously however, and we advise doing so. The One-Ten is a possible exception to this rule, because it uses acorn tubes.

The cost figures given above are for receiver filaments only, not including the rectifier. There is no particular virtue in leaving the rectifier on when it is in a separate power supply.

Speaking of fixed frequency, many amateurs operate in one band exclusively. Our experience has been that for this kind of work the HRO Junior is by far the best bet. When purchased with one coil range, it provides a de luxe single range receiver at no more cost than a less efficient general purpose set. Furthermore, extra equipment, such as a crystal filter, or an S-meter, or more coil ranges, can be added at any time. You can choose just exactly the equipment you need, thus getting maximum performance at minimum expense, "tailored" to fit your requirements.

JAMES MILLEN

A Feedback Compensator

(Continued from page 14)

back and simultaneously increasing the detector screen voltage, a stage is reached where signals are amplified very greatly and with perfect stability. The regeneration control is not in the least critical, which contradicts previous experience when raising the output from a regenerative rig. This result was not the one particularly sought for in our experiments, but may easily prove to be the most desirable advantage of the type of control described here. The process can be carried on past the point where the grid-leak detector is an efficient rectifier, judging from results with the experimental set-up.

SELECTIVITY

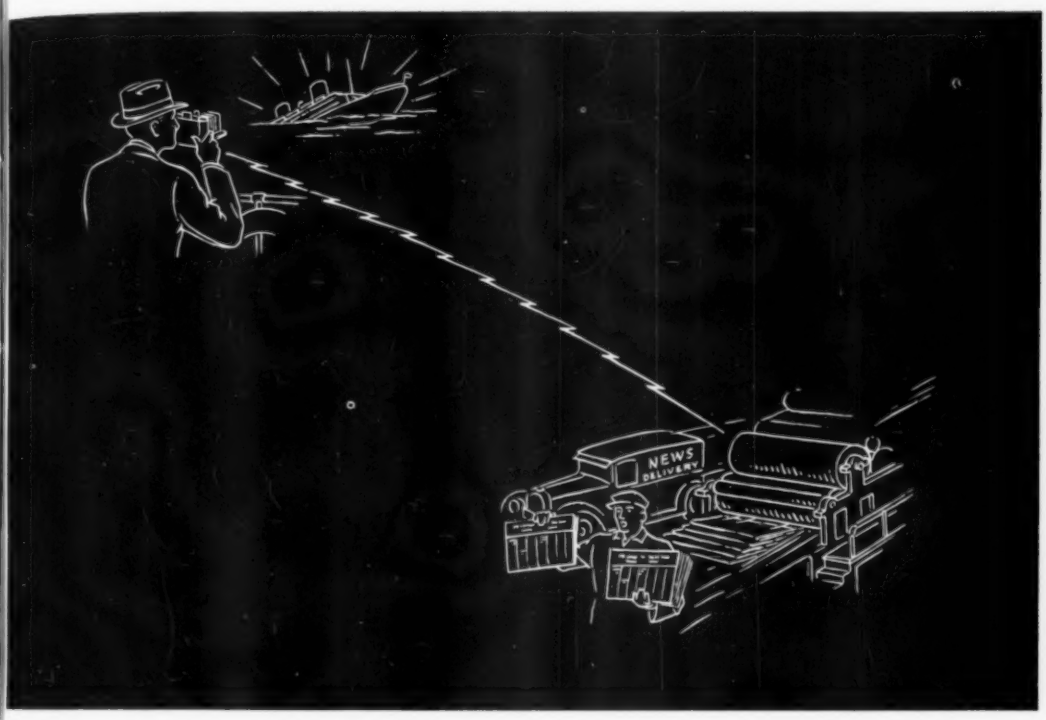
Examination of the circuit diagram shows that there are several common impedances between the first and second tuned circuits. It follows that the effective selectivity of the rig depends on the degree of coupling and the tuning of the two circuits. The feed-back compensator introduces a controllable degree of coupling in addition to previously existing couplings. Oscilloscope observation of the output, using an r.f. oscillator modulated at 20 kc. as the signal source, shows that the selectivity curve can be modified from a single rounded hump to a "square-shouldered" curve, and finally into a double-peaked curve. These are easily recognized as the series of curves obtained when the coupling of two tuned circuits is gradually increased from less than critical to more than critical values.

It would be impossible to specify the exact conditions under which any one type of curve might be produced in the receiver; suffice it to say that any one of them can be recognized by careful attention to the side bands heard, particularly when tuning through two "adjacent" signals in an amateur 'phone band. Certainly a 'phone signal sounds better with a square selectivity curve than with the sharp peak usually associated with regenerative detectors, and also found in superhets with conventional intermediate-frequency amplifiers.

C.W. RECEPTION

There appear to be at least two other effects obtainable with the circuit described above, but they were somewhat difficult to establish with any degree of certainty in practice. The first concerns only the c.w. addict with a conventional 3 or 4 tube receiver. When the feed-back compensator is carefully set in a position which substantially neutralizes the r.f. stage, it is possible to tune in a signal with the r.f. stage "right on the nose," and to have the detector oscillating at a slightly different frequency for the beat note. This trick, comparable to the single-signal effect used in all good superhets, practically eliminates one of the two beat notes heard with an autodyne detector. A small panel-controlled trimmer condenser in the first tuned circuit is very helpful in getting the exact setting required.

News Pictures Make The Deadline



THE reporter and the camera-man join hands in bringing to the public the news of the day. And as telegraph wires and radio flash the reporter's story from city to city with the speed of light, the camera-man's pictures travel at the same speed, ready to make the same deadline—ready to appear in the same edition with the story.

The electron tube makes possible the transmission of news pictures by wire and radio—and in every electronic circuit—in the moderate frequencies of wire transmission or in the high frequencies of radio—the insulation must be of the highest quality. In the commercial transmission of pictures Isolantite*-insulated circuits and equipment contribute to the dependability of the service.

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DYNAMIC SELECTIVITY

The other effect which seemingly occurs at some settings of the controls is that of complete suppression of adjacent channel signals. That happens to be the goal of a lot of miscellaneous experimenting with receiver circuits here, although we have strayed occasionally into noise-suppressors, automatic gain controls, etc. The basic idea seems to be somewhat like this:

Certain adjacent-channel signals are passed through the tube to the second tuned circuit and may be considered to drain off through either the condenser or the coil, depending on whether they are high or low in frequency as compared to the desired signal. If these side frequencies could be fed back negatively to the grid circuit without feeding back the desired signal degeneratively, there should be a definite gain in effective selectivity. Study of the plate circuit impedances shows that, outside of the tuned circuit, the least current flows at the resonant frequency, and relatively larger currents for other frequencies. This discrimination against the resonant frequency can be employed usefully if the currents involved are passed through an impedance representing a noticeable fraction of the total impedances in series in the complete plate circuit.

In the circuit shown in Fig. 1, these currents must flow through the feed-back coil in order to complete the circuit from plate to cathode. The coupled impedance of the grid circuit constitutes the load for the feed-back currents. In a circuit using a separate primary winding for the second tuned circuit, the by-pass condenser from the low potential end might be connected permanently to point "A" in the circuit, leaving the screen-grid by-pass condenser connected to ground as shown. A previous trial of this circuit trick in various stages of a superhet failed to give a result which was not obscured by the effects of automatic gain control, circuit tuning, etc.

SOME RESULTS

The experimental three-tube receiver, using the feed-back compensator, included a pentode audio stage working into a dynamic speaker. The frequencies covered were from 12 Mc. to 17 Mc. Most domestic and several foreign short-wave broadcast stations within this range drove the audio stage to capacity. Incidentally, the set exhibited a remarkable tolerance of fading and signals of different levels, possibly because of the automatic gain action of the grid-leak detector. The r.f. tube was a 954 acorn having a sharp cut-off characteristic. There was no noticeable cross-modulation from strong signals when degenerative feed-back was used, except from transmitters within a half mile. Perhaps the substitution of a variable-mu pentode or introduction of an extra tuned circuit between antenna and receiver would help to reduce blanketing by these local stations.

AN ADDED CONTROL

The feed-back compensator described here may seem an unnecessary added control, since the same effects can be produced by other means. But

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This Newest Eimac Development Fills a Long Felt Need!

A pair of Eimac KY21 tubes operating in the conventional full-wave rectifying circuit, provides a D.C. output power of 3500 volts at 1½ amperes; regulates the flow of current by means of the grid control; provides the means to key 3 K.W. of power with the simplest *low power* circuit; eliminates heavy, arcing relays; permits high power operation in congested areas, by practically eliminating all "key clicks."

Eimac KY21 is essentially a mercury vapor rectifier tube to which has been added a control grid, the only tube of its kind available to amateurs, designed and rated for maximum utility, in amateur equipment. The advantages of keying through KY21 tubes is immediately apparent. Since the primary of the transformer is constantly energized, "blinking lights" are minimized. Elimination of keying relays removes "tails" from signals more completely than an equivalent filter for primary keying. The main filter smooths the R.A.C. and eliminates "key clicks" simultaneously. Such a filter consisting of 8 henries and ½ to 2 mfd. will give T9X signals and permit "weights off" bug operation.

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hams cannot all apply laboratory methods to hook those elusive DX stations. So the added control is suggested as a means of balancing up the unknown quantities with another one. It is offered up to the tender mercies of the set builders, to be modified, moved thither and yon, replaced by double variable condensers or tapped coils, and changed into a link circuit, or Colpitts feed-back. Variations which we have tried all seemed to have possibilities.

For application to the front end of a superhet, the feed-back compensator should be helpful in removing erratic action, whether deliberate regeneration is used or not. Perhaps combined control of the feed-backs in both r.f. and detector circuits can be developed to the point of being reasonably fool-proof. Certainly the first circuits in a superhet are subjected to most of the conditions affecting the simple circuit discussed here.

Acknowledgment is due and offered to anyone whose circuit design, textbook, handbook or magazine article may have suggested some part of the "feed-back compensator." Certainly, H. S. Black's contribution of the "Stabilized Feedback Amplifier" was largely responsible.

Homebuilt Velocity Microphone

(*Continued from page 33*)

approximately one-half inch and the ribbon so cut as to leave approximately a sixteenth inch or less spacing on each side.

The bakelite pieces at the ends support the ribbon and are drilled to accommodate the machine screws holding the brass clamps which provide contact with the ribbon. These clamps are so bent that the ends are turned up, thus putting strong pressure upon the ribbon. A very important point is to be sure to use only well-polished brass for these contacts. If the brass is lacquered, be sure to remove the lacquer with fine sandpaper. The use of aluminum or other metals—aluminum especially—will result in poor response and low sensitivity because of contact resistance.

FORMING THE RIBBON

The task of cutting the ribbon demands a little patience, and you must expect to gouge and rip a few trial ribbons until you acquire the right touch. A half-microfarad condenser will furnish plenty of material for a great many attempts.

Place a foot-long strip of the foil upon a piece of flat and rather heavy cardboard. If there are any wrinkles, smooth them out with light, long strokes of the fingers. Place a straight edge—a brass-edged rule is ideal—over the foil so as to leave the desired width of ribbon. Press the straight edge down firmly so that the ribbon will not slip and with a steady, slow motion draw a razor blade along the straight edge. Practice on a few odd pieces will give you the knack and let

(*Continued on page 76*)

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600	600	2	2 7/8 x 1 13/16 x 1 1/16	2.06
600	600	4	3 3/8 x 2 1/2 x 1 3/16	2.65
1000	1000	1	2 1/8 x 1 13/16 x 1 1/16	1.76
1000	1000	2	4 x 1 13/16 x 1 1/16	2.65
1000	1000	4	4 3/4 x 2 1/2 x 1 3/16	2.94
1500	1500	1	4 x 1 13/16 x 1 1/16	2.21
1500	1500	2	4 1/4 x 2 1/2 x 1 3/16	3.23
1500	1500	4	4 3/4 x 3 3/4 x 1 1/4	4.70
2000	2000	1	3 3/8 x 2 1/2 x 1 3/16	2.65
2000	2000	2	4 x 3 3/4 x 1 1/4	3.53

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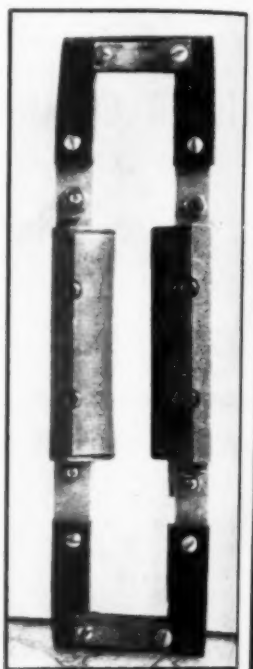
Homebuilt Velocity Microphone

(Continued from page 72)

you determine for yourself how much pressure to use so that the ribbon will cut rather than tear. Cut the ribbon at least a couple of inches longer than necessary.

Assuming that you have cut a ribbon of desirable width, i.e., about $\frac{1}{16}$ inch narrower than the ribbon slot, the next problem is to put a crimp in it. This wrinkles the ribbon slightly and gives



MAGNETS, POLE PIECES AND RIBBON SUSPENSION BEFORE THE RIBBON IS PLACED IN POSITION

it extra springiness so that it can be stretched when mounted and yet will respond to very slight sound pressure. The wrinkling process gathers the ribbon together and it will stretch like a coil spring. In mounting the ribbon we make use of this property to keep the ribbon snug so that the changes in position of the microphone do not cause it to sag. After crimping, a ribbon will withstand considerable pull but be careful not to make it too tight. The photograph should be self-explanatory as to method of crimping. Only slight pressure is used on the gear which is run over the ribbon. The felt mat allows the ribbon to give and accommodate itself to the teeth.

Now that you have the ribbon ready and the entire pole assembly rigidly mounted to the magnets, you are ready for placing the ribbon in position. The pole pieces should be "dodged" around slightly by loosening the machine screws in the assembly so that the ribbon slot will be straight and of constant width. The brass contacts should be in position but sufficiently loose to enable the ribbon to be slipped beneath them. Slip each end of the ribbon under the contacts. Leaving an inch or so over-extension, clamp the ribbon into the proper position at one end. You will have to pull

the ribbon taut with the fingers at the opposite end and juggle it around slightly to get it centered properly. With one end clamped the juggling is repeated at the opposite end and adjustment of tension so made that when the entire assembly is laid flat, ribbon parallel to table top, the ribbon does not sag. Leads may be now soldered directly to the brass strips without danger to the ribbon. The excess ribbon may be cut off to the ends curled over the edge of the bakelite.

OUTPUT CONSIDERATIONS

The impedance of the ribbon is on the order of half an ohm. This must be matched to the impedance of the input circuit of your amplifier. If you are going to use the "mike" in close proximity to the preamplifier, say within 6 feet or so, it is possible to run the leads from the ribbon to a ribbon-to-grid transformer. In general, it is preferable to utilize a ribbon-to-line transformer, matching the ribbon to a 50- or 200-ohm line. This was mounted in the little cupola of the case, as shown in the photograph. Lines may be up to a thousand feet long without heavy losses.

The cable should be shielded and this shielding bonded to the magnet assembly and the core of the ribbon-to-line transformer. Lacking a transformer of this type, a working substitute may be found in a universal output transformer such as is used in coupling speaker voice coils in receivers. By connecting the ribbon to the lowest-impedance taps and the line to the primary of the transformer, a suitable combination may be found. A good transformer costs but little, and the better performance and hum-free operation from use of correctly designed units and good grade microphone cable are well worth the extra expense. Shielded wire may be utilized for cable, but a definite increase in gain will be observed when using the microphone cable.

Success of velocity microphones depends also upon the preamplifier used, and the manner in which the lines are coupled or matched has considerable to do with not only the gain but the hum level. A good input transformer, line-to-grid, is desirable. If you cannot afford one of the better balanced-winding types which tend to minimize magnetic pickup, use an ordinary one and if necessary place it in extra shield cans and even mount it in a position a few inches from the chassis in a spot which gives minimum hum pickup. Shielded leads, well-grounded preamplifier, and a decent input transformer mean low hum level, surprisingly good pickup, and freedom from "headaches."[2]

As to results, the following method was used in making comparisons with other types of microphones, including commercially-available products of both high and low cost. A speaker in a remote room in the house was connected to the output of the amplifier. A number of individuals listened to the various tests. A regular alarm clock can be heard ticking some 20 feet away

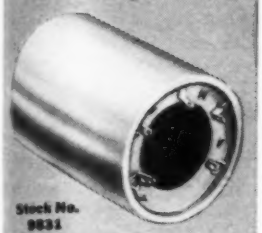
[2] The preamplifier used with these mikes incorporated a 6C6 pentode followed by a 6C6 triode connected. Output level at plate of latter is pleasing headphone volume.

HERE THEY ARE!

RCA Television Parts FOR KINESCOPE DEFLECTING CIRCUITS

RCA KINESCOPES
1800 and 1801

Again RCA encourages the amateur and television experimenter by making available the basic units for the construction of Kinescope deflecting circuits. These parts are of traditional RCA design, include the finest engineering features and are manufactured to give long service. They are for use with RCA 5- and 9-inch Kinescopes, Types 1800 and 1801.



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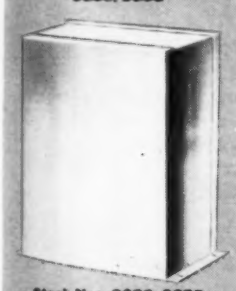

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VERTICAL OUTPUT REACTOR . . . A fine autotransformer for matching output of deflecting circuits to deflecting yoke vertical circuit. 120 henries inductance. 3800 ohms DC resistance. Stock No. 9833. . . . . Net Price **$3.00**

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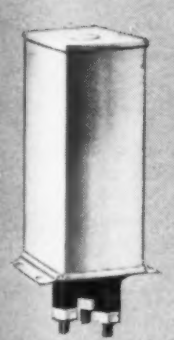

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• • •

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Ask your distributor, or send 10 cents to Camden, N. J., for a commemorative advertisement on RCA's television tube announcement.

RCA Parts

RCA MANUFACTURING CO., INC., CAMDEN, N. J.
A SERVICE OF THE RADIO CORPORATION OF AMERICA

from the mike. The breeze blowing through the window screen is plainly audible. In fact nearly all sounds such as those made by birds in the garden outside the window, cars going by on the road, people talking and moving about in the next room, are readily picked up and recognized. A person speaking in a medium-sized room can be heard from any position in the room. When used on a P.A. job outdoors excellent pickup was experienced in reënforcing dialogues and group singing.

Fidelity and frequency response were checked by placing the mike in the same room with an electric phonograph and picking up the actual sound emitted from it. Using a frequency test record giving notes continuously variable from 10,000 to 30 cycles, the microphone picked up and carried all frequencies from 7000, the upper reproduction limit of the phonograph, to the deepest recorded. Similar tests on the air yielded similar results.

In direct comparison with an RCA PB-90 velocity microphone (this is the type formerly used with the 20-watt portable public address equipment and at Radio City) the home-made microphones gave a creditable performance, although the commercial product is somewhat more brilliant and has slightly higher output. All in all, the comparison was very favorable to the home product, and, considering the difference in cost, the results are most satisfactory and highly pleasing to the constructor.

A few precautions must be taken in using microphones of this type on the operating desk. They will, of course, pick up hum by induction from near-by power transformers and speaker fields. Accordingly they must be so located as to pick up minimum hum when used near receivers. Generally a three-foot separation will reduce hum to a negligible level from this cause.

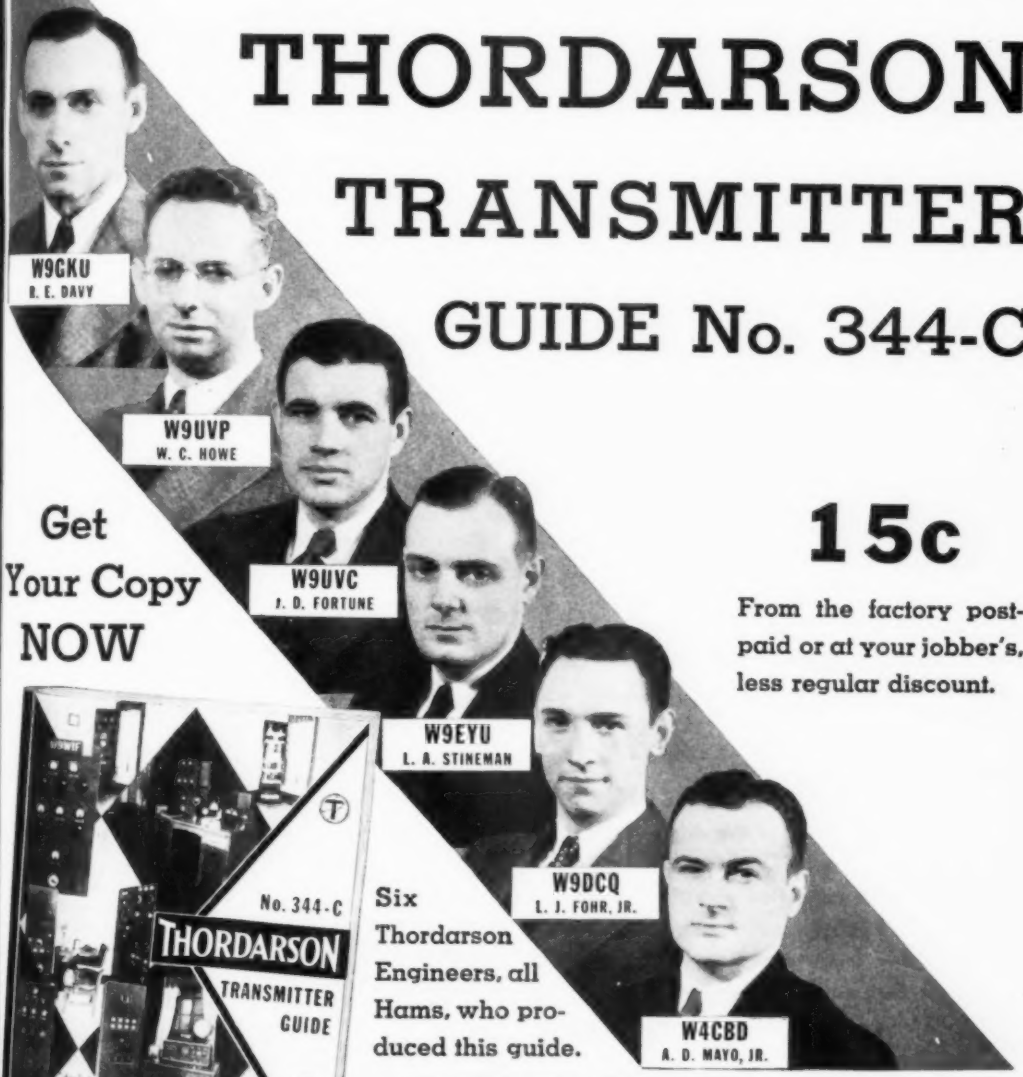
However, they do allow the operator to sit back in his easy chair, to make notes at his leisure, without the necessity of holding the mike to his lips, and if visitors are present all can take part in the conversation from their chairs without stirring. At W1JXP two of these mikes are used, connected in parallel, giving a pleasing binaural effect. The pair so connected can hardly be distinguished in performance from the RCA mike previously mentioned.

Room echo and reverberation, of course, enter the picture prominently if full sensitivity is utilized. For close talking purposes the gain can cut to reduce background and room noise. Curtains, wall drapes, and bare windows all exert influence either by sound absorption or reflection. A rug hung on the wall at the rear of the operating desk and directly behind the microphone prevents, to a great degree, the reflected sound wave from the wall entering the rear of the mike and causing echo effect.

The cases shown were made from basswood, the rods are dowel sticks and the grill cloth thin silk. Little, if any, cavity response or boominess seems evidenced from the use of four instead of two magnets to increase magnetic intensity, nor from the housing.

OFF THE PRESS

THE NEW 1938 THORDARSON TRANSMITTER GUIDE No. 344-C



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4th Edition

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The writer wishes to extend his thanks to his brother for his assistance in solving various mechanical details of construction.

A.A.R.S. Activities

(*Continued from page 34*)

One of the most interesting phases of the Army Amateur System is cryptanalysis, which is taught and conducted by each Corps Area Signal Officer, with experts in each Corps Area. Cryptanalysis in itself is a very fascinating hobby.

During the Christmas Holiday traffic season, KA1HR numbered originated messages consecutively from 1 to over 2000.

Using information obtained by radio, several Corps Areas work problems in locating unknown stations.

3.8% of the total number of amateurs in the United States are A.A.R.S. members; 80% of the A.A.R.S. members are also members of A.R.R.L.

On December 13, 1937, Oklahoma City vicinity suffered a severe sleet storm with ice-covered power, telephone and telegraph wires. The situation was efficiently handled by local amateur operators.

On February 5th, amateur traffic handling in Shanghai, China, was discontinued.

Another speed contest is contemplated this season, the transmission to be made from both the East and West Coast. Details will be announced later.

Briefs

W8PAJ, Clarksburg, W. Va., worked all states within about three months after getting his call; he uses a pair of tens in the final stage.

—...—

An example of the real spirit of amateur radio is given by W1EHT. He writes, "On the summit of South Pack Monadnock, Peterborough, N. H., there have been erected two masts about twenty-five feet in height. On one is mounted a Pickard, on the other a matched impedance antenna, both complete with spaced feeders of sufficient length that by parking a car in the right position both can be used, one for receiving, the other for sending. These were erected by W1CJT and an S.W.L. named Sawtelle, and are left there all summer for any ham who wishes to use them. It is an excellent 56-mc. location, the mountain being 2280 feet above sea level, and only about 50 miles from Boston. Here's a chance for some good portable work, thanks to W1CJT and his friend."

—...—

The membership list of the League is not available for commercial circularizing but may be made available, in a Section or an area not exceeding one Division, for pro-amateur and non-commercial purposes, upon the application of any member and at his expense. Thus for some years past the headquarters office has supplied lists of names or has addressed envelopes for convention committees, candidates in A.R.R.L. S.C.M. and Director elections, etc., whenever requested to do so. The service is available of course to all candidates in elections, or for other worthy pro-amateur purposes. The actual cost of materials and labor is charged. Because this section of our office is heavily burdened, however, we require at least two weeks' notice to do the work.

CQ WCFT

(Continued from page 13)

vari-colored coral reefs, tall, stately cocoanut palms, and the easy-living brown-skinned islanders. Before long the spell of the islands began to take hold. Time was meaningless. The motto was "Never do to-day what can be done to-morrow." It is really a pity that modern civilization is doing so much to ruin the natural beauties of these pearls under the Southern Cross.

Turning northward, we soon reached the little atoll of Pen Rhyn. Captain Viggo, who is ending his days as the British Resident here, welcomed us warmly. He is one of the last of the old South Sea traders left alive, and he kept us entertained with his stories of days gone by. It was he who supplied the basis for Nordhoff and Hall's story, "Hurricane," which recently appeared on the screen. The book was dedicated to him. Interestingly enough, he had been through seven hurricanes—four at sea on his schooner and three on low atolls. He claimed that the storm depicted in the book was only a small one and hardly worthy of the name "hurricane."

After calling as far north as the Line Islands, Christmas and Fanning, where wrecks of Spanish galleons bound from the Philippines to the Mother Country laden with treasure lie side-by-side with modern steamers loaded with coal and lumber, the *Yankee* turned southwestward through the Phoenix Group, now famous as the possible grave of Amelia Earhart Putnam. They are just tiny coral atolls—deserted—surrounded by some of the worst shark-infested waters I have ever seen.

Then, after calls at Tokelau, Swains Island, Upulu (Apia), we reached the American Naval Station, Pago Pago, on Tutuila. What a pleasant relief to see fellow countrymen again and to enjoy ice cream, clean and orderly settlements, and movies! While here we found Samuel Goldwyn, Inc., doing some location work for their coming picture, "Hurricane." They were badly in need of a schooner to take part in the story, but the ship that they had bought for the purpose was in California and the job of "faking" shots back in Hollywood would not be too satisfactory. The *Yankee* turned up just in time and moved out on location a few days later to make most of the shots showing the schooner of the story sailing along off the reef and going through it. It gave us quite a kick to suddenly "break into pictures" in such an unusual way.

From American Samoa we worked our way slowly out of the Polynesian region, past the islands of Niuatobutabu, Niuafoou, Uea and many others famous in the romantic lore of the South Seas, into that of the Melanesians to New Hebrides, one remaining stronghold of cannibalism. The interior of the larger islands here have never been visited by the white man. To-day, 1936 A.D., the few coastal settlements of Malekula and Santos hear rumors of great cities and even nations of natives living inland that have never been seen and that don't know any world other

than the mountain fastnesses where they live. In the Solomons, islands which have probably the bloodiest history of any, we met old traders and recruiters who could spin yarns of the past that alternately shook us with laughter and then made our hair curl. Some of the islands in these parts were discovered by the Spanish explorers shortly after Magellan made his world-circling trip. Then they were lost for years and remembered only as the myth of a few crazy explorers, only to be re-discovered in comparatively recent times.

We left the Pacific Islands at last and sailed on to New Guinea, where it may take an experienced bushman seven months to walk from one side of the island to the other. Here, far back in the mountainous interior, one can find natives who have never seen the sea. Strangely enough, they use sea shells brought to them by intertribal barter as a medium of exchange. Here a sharp contrast between the new and the old exists, for with the discovery of gold in the interior the white man has brought the latest scientific instruments and conveniences to wrestle this precious metal from the ground and has moved right into primitive surroundings where the people are living in the stone age.

The *Yankee* continued on to visit the pearling center of Dobo in the Aru Islands, Banda the old spice port from whence the East Indies got the name "Spice Islands," Ambonia, Flores, Komodo, where the only dragons in the world are found, Bali ('nuf sed!), Java and Singapore. Here, because labor was cheap, the Skipper decided to have some alterations and repairs made. This necessitated a lay-over of about a month, which left ample time for me to see some of Asia on my own. A quick trip overland through Johore and the other Malay States, Siam with its historic and interesting Bangkok, Indo-China and its famous Angkor Wat, and return, more than justified the expense of money and time.

After this brief rest, if it may be called that, the *Yankee* sailed on once again. This time the winds took her to Sumatra and Nias. The latter is a small island off the west coast of Sumatra with very interesting native life. These people are intensely proud of their athletic prowess and fighting ability. Next we headed off across the Indian Ocean for Zanzibar. As the winds carried us near to both Diego Garcia and the Farquhar Islands, we called briefly at them to see what they might hold of interest.

As this article is being written at sea between the Farquhar Islands and Zanzibar, it will be some time yet before the final chapter of the cruise is written. Briefly, present plans are to go from Zanzibar to Beira, Lourenco Marques, Capetown, Rio de Janeiro, Georgetown, British Guiana, St. Thomas, Virgin Islands and on back to Gloucester to complete the circumnavigation. Our plan is to arrive back home at 2:00 P.M. on May 1, 1938, exactly a year and a half after we sailed. Barring unforeseen accidents there is no reason why we shouldn't make it.

If there is any ham healthy and not afraid of work, with some money, here is the bang-up

chance of a lifetime. He should hold a commercial second-class telegraph license, have had plenty of experience working both DX and TFC, "know his onions" when it comes to ingenuity in making the parts available do the trick in repair work, and be able to live congenially with eighteen people in close quarters for a year and a half. Sailing experience is useful but by no means necessary; as this boat is run entirely by an amateur crew it is best to be as well-equipped as possible. Many people meet a few of these requirements but the person who is versatile has just that much better chance when it comes to competing for the berths. On the present cruise the party is made up of eighteen in all; the skipper, his wife, a small son, the cook, two girls and twelve boys. The latter were chosen from over a thousand applications. The average age of the whole crew is 22 years.

So remember, WCFT sails again in the fall of 1939 and is in need of an operator who will be chosen from amateur ranks. If anyone is interested in sailing on her get in touch with me.

A Pack Set for 200 and 300 Megacycles

(Continued from page 42)

of clumsy microphone cable. The signal received is piped back to the station through a remote amplifier and telephone lines.

The reason for the receiver in the pack set is so that the one wearing the pack can receive instructions from the remote engineer, or so that when two pack transmitters are used in conjunction, each announcer carrying the pack will know what the other is saying and doing.

The receiver used in the pack transmitter was designed after an article in November, 1934 *QST*.[1] The circuit diagram is shown in Fig. 2. The receiver used for picking up the signal from the pack transmitter is a National 1–10. It was found necessary to make some slight changes in the 1–10 receiver so that it could be tuned more conveniently at 300 megacycles. The removal of two stationary plates from each of the tuning condensers, plus spreading the turns of each coil, usually will accomplish this. Output transformers also were added to match 50- or 500-ohm lines, these transformers being shunted across the plate circuit of the 6C5 audio tubes. The antennas used with the 1–10 receiver are of the tuned type, being made from a 72-ohm concentric transmission cable. The outside copper tubing is an odd number of quarter wavelengths, the projecting wire being half wavelength long. In our first test quarter-wave antennas were used on both transmitter and receiver. It was found that by using half-wave antennas on the receiver and the transmitter about 4 or 5 db gain could be expected. The antennas now being used are one-quarter

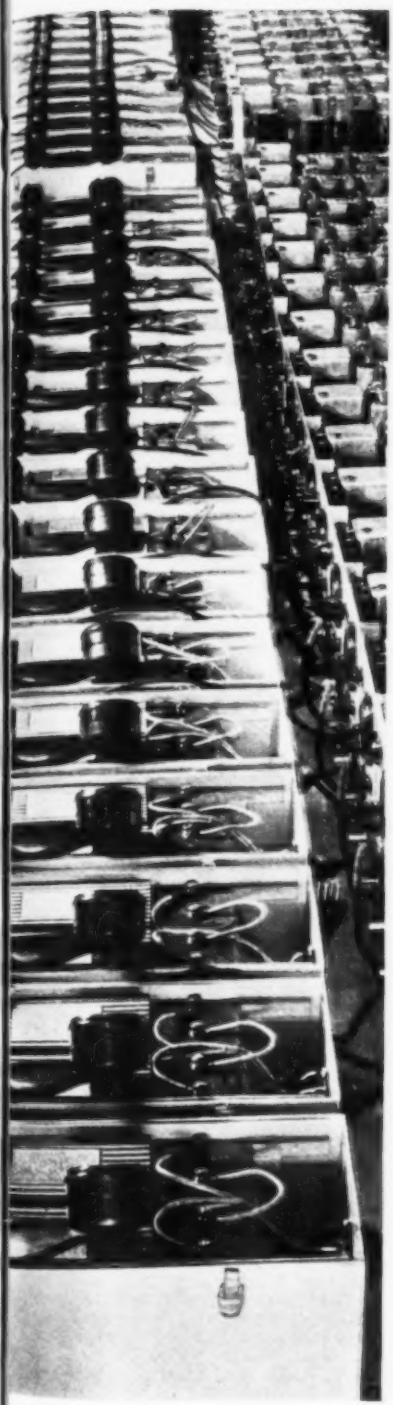
[1] Hull, "Practical Communication on the 244-Mc. Band," *QST*, November, 1934.

wavelength long on the receivers feeding the remote amplifier.

Among tests of interest that have been made was one of enclosing the pack transmitter in a completely copper-plated cabinet. The receiver was at a distance of approximately two hundred feet. There was very little drop in signal when the transmitter was completely enclosed, either on 200 or 300 megacycles. One of the most remarkable things about the 300-Mc. signal is that no interference of any kind has been received, and very, very little on 200 megacycles. The reason the above frequencies were chosen was because of the lack of interference and the greater compactness possible in construction as compared with frequencies in the vicinity of 40 megacycles.

One of the most serious problems so far experienced on 200 and 300 megacycles is the variation of signal strength because of interference effects in and around metal structures. This condition seems to be more severe on 300 than on 200 megacycles. It is not noticed in the open until the transmitter is a half mile or more away from the receiver. Rapid physical movements of the person wearing the pack transmitter had no effect on the reception within reasonable distances. A tap dance was even done and described by the announcer with the pack on the back with perfect reception.

Twenty fifteen-minute periods of broadcasting using the 300-Mc. transmitter have just been completed for the Kansas City 1938 Auto Show, held in the Exposition Hall of Kansas City's Municipal Auditorium. The conditions under which the ultra-high-frequency equipment worked are undoubtedly as severe as will ever be generally experienced, due to the number of large metal posts, balconies, and steel auto bodies. It was found necessary on several occasions to move the receiver to different locations during certain broadcasts. Another interesting experience was that the reception of the 300-Mc. signal was very spotty even at close distances when working under low ceilings that contained a great deal of steel construction. It was found that reception was more dependable during our 6:00 P.M. broadcasts when the crowds were lightest.



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I. A. R. U. News

(Continued from page 56)

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R. F. Interference from Power Circuits

(Continued from page 49)

before you can get the light to stay on. Go to the meter board in the cellar and check to see if any of the fuses are warm; if so, remove the fuse and clean the contacts or put in new ones. Don't let two pieces of BX cable run together or touch any pipes. Check the bell transformer for secondary and primary connections. Check the condition of the switch blades in the main switch.

Now on the distribution transformer secondary or in other houses in the neighborhood, the causes of noise other than those already described will probably be from some of the following:

Source of noise	*Sound Produced*
1. Secondary wires in trees	Snapped fingers
2. Loose taps at the transformer	Bronx cheer
3. Guy wire in the secondary lines	Same cheer, twice as many people
4. Appliances:	
a. Electric razor	Bumble bee
b. Oil burners	Ten airplane motors
c. Water pumps	Grinding crystal
d. Floor sanders	Man humming a tune
e. Electric train	Horse fly trying to get out of a window
f. Thermostats	Machine gun

Now the transformer pole; first, check all connections on both sides of the transformer, primary and secondary, next the lightning arrester, then the insulators. Dry-process porcelain insulation will cause a low-pitched interference in dry weather, but in wet weather there will be no noise because of direct grounding. Cut-out boxes often leak, and occasionally the fuse in the box becomes loose.

Last but not least, check the ground connection on the transformer.

On the line, check for guy wires rubbing the primary line, burned insulator pins, loose underground services and trees which the primary line runs through. Tree noises are worst when the sap is in.

On the street-lighting circuit look for safety coils, bad lamps, bad insulators, swinging fixtures and loose fixture heads. Remember that few noises pass from the secondary lines to the primary lines, but all primary noises are heard over several secondaries. If your noise is only on in the evening, check house wiring and look for street-light circuit trouble.

The writer still uses the "persuader" system for finding the source of interference on the primary lines, and this is it:

Material: one large heavy wooden mallet, good auto radio installation.

Procedure: Smack every transformer pole and listen for results. They usually respond nicely. I have had everything from the noise disappear to transformers fall at my feet.

Results: Equipment replaced either because defective or missing.

Brief

Did you know that W8DAM lives in Niagara Falls? —*W8KSY.*

Move over, fellows!

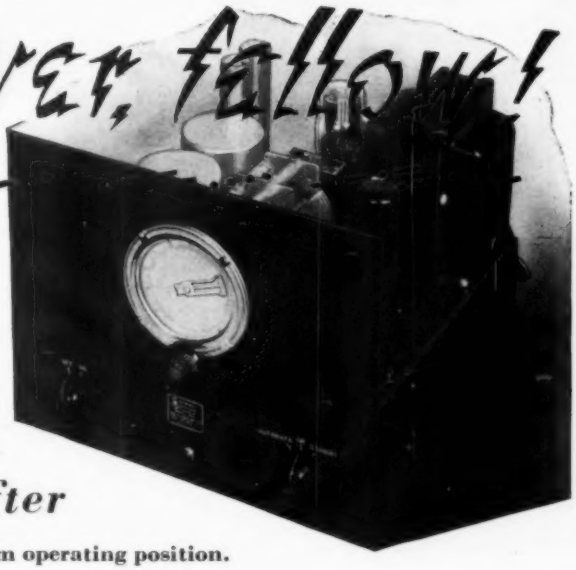

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Image Rejection

(Continued from page 23)

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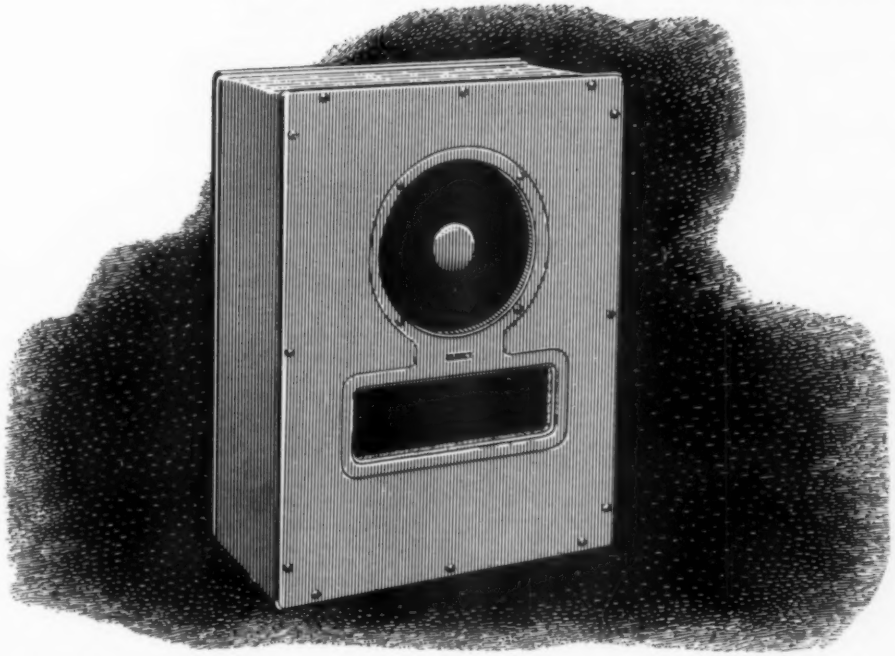

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STATION ACTIVITIES

DAKOTA DIVISION

NORTH DAKOTA—SCM, Ernest Bloch, W9RZA—BMR, DYA, PGO and ZTL reported scores in the QSO party. ZVE, IEZ, UNV, UKD and UNU held a get-together at UNU's shack to celebrate ZVE's wedding anniversary. UNU installed a d.b. mike. WWL has new rig, running 450 watts on 1.75-Mc. 'phone. STT is rebuilding rig. STJ plans on 1.75-Mc. 'phone rig with '46's final. PGO runs 150 watts to T55 on 3.9 and 14-Mc. 'phone and 3.5 and 7-Mc. c.w. PJT has pair of '46's final. ZTL needs only five states for W.A.S. Minot hams have organized a radio club with YJL, YJW and YJO as Pres., Vice-Pres. and Secretary respectively. ZGR has new Sky Buddy.

Traffic: W9RZA 40 BMR 16 DYA 16.

SOUTH DAKOTA—SCM, Andrew J. Kjar, W9SEB—VOD is settled at new QTH. AZR made B.P.L. with a nice total. FOQ makes all the fellows in the State Net glow with envy when he tells about the DX he works each night on 14 Mc. after net schedules. The Rapid City gang is building a club emergency rig consisting of a 6C5 crystal Pierce oscillator to an 807 final in a Lynch cabinet, powered with a genemotor. YOB is giving code practice for about a dozen locals. ZBU is on 14 and 7 Mc. Will all those who have received AEC application blanks and those who have not received the blanks and are interested, please give this matter attention. OXC, our new O.B.S., will make his broadcasts each Sunday at 10:30 A.M. and Wednesday at 7:00 P.M. on 3931 kc., so listen for him for important news. WLP is having good luck on 3.5 Mc. with his tens in final. LBU is putting a pair of 809's in final. PLP has his 'phone rig finished and is using one of the power company's guy wires for antenna on 1.75 Mc. QLP in Ft. Meade is new member of A.A.R.S. and keeps daily schedules with State Net; he is operator of WZM, Army station. South Dakota results to date in the Dakota Division QSO party: SEB 1008, FOQ 712, USI 708, AZR 516, YNW 504, DIY 384, QAK 153, QLP 120, YOB 106. We are indebted to QLP for securing information about the interference on WLW being caused by a spurious frequency from a powerful Mexican broadcast station, so tell your B.C.L. friends that it is not coming from your code stations, gang. Big event of the year was the passing of 9DES from the ranks of bachelors. Congratulations, Harry, and lots of luck. CRY's present rig under construction is a pair of '52's. RWE, after many years of hard work, grief and other things, including a splash into matrimony, finally got on with an FB rig. ZRA moved into home of his own where the voice of ZRA blossoms forth in full bloom (has sound-proof room in basement so XYL can't hear him). YNW and CQK are heard daily. ZPA got a card from a K6 he worked with 20 watts to a 59 rig. USH and USI have their rig working on all bands and report working 30 Europeans on 28-Mc. 'phone and c.w., using rotary beam antenna, during Christmas vacation. WWN burns up the ether with a pair of T20's final. UDI is on with a 6L6-T20 rig. USI is another of the lucky fellows to make W.A.S. ZCC reports using keyer tubes to eliminate key clicks. PVP has lots of fun on 1.75-Mc. 'phone. WUU, whose station was destroyed by fire, has rebuilt and has worked 28 states on 3.5 Mc. using a single 31 with 4 watts. ALO keeps regular schedule with WUU. WOW is on 7-Mc. c.w. and 1.75-Mc. 'phone. SRX uses a T55 final while building final stage to a T200. ZOQ is building a portable rig. IQZ is grid-modulating his tens final on 3.9 Mc. WPA is helping a model airplane enthusiast build a radio-controlled gas-model airplane. QAK tried his rig with emergency battery power and got RST 539X from Milwaukee, Wis., with only three quarters of a watt input; he also has a new Sky-Buddy.

Traffic: W9AZR 653 SEB 89 YOB 12 FOQ 10 Z 6CC WPA 3 VQN 69.

NORTHERN MINNESOTA—SCM, Edwin Wicklund, W9IGZ—KQA is building a 1.75-Mc. 'phone rig. RVU reports he receives some of the old gang on 7 Mc. in San Diego, Calif. GSJ was married first of year. ZQB worked K6 and K7 on 7 Mc. with T20 final. ZGI has 46 states toward W.A.S. using pair of 6L6's final. CWI is building new frequency meter. BLY has new NC81 receiver. DGM sports new H.R.O. receiver. HEN likes A.R.R.L. members contest better than SS. GZO and JHS are on 1.75-Mc. 'phone. SYG moved to Princeton, Minn., and is active on 3.9-Mc. 'phone. LSC is proud daddy of a Jr. opr. HEO rebuilt exciter to 89 and 6L6. BHY is pleased with new NC81X. QNI is new St. Paul ham. BBL sponsored Feb. meeting of St. Paul Radio Club. YOO worked K4FCG on 1.75-Mc. 'phone. THU is on 1.75-Mc. 'phone. WQF, ZMQ and WCC are on for a round table every noon. BVH is on 3.9-Mc. 'phone. YTL worked G6WY on 7 Mc. UVA works nice low-power DX. WVM is on 14 Mc. with 10-watt rig. NBH is on after about three years' absence from ham radio. DYZ installed Class B modulators. BP is looking for good operators for the Naval Communication Reserve. The St. Paul Radio Club was fortunate to have the Bell Telephone Co. send over two experts on the different phases of telephone communication; some of the equipment demonstrated was the artificial larynx and a voice scrambler. UHS is on 1.75 Mc. with 8-watt rig. RJF has second-class telephone ticket. FEP is on 1.75 Mc. with low power. YAP and UDK can be found regularly on 1.75-Mc. 'phone. PZU is on every Sunday at 5:30 P.M., 3903 kc. with A.R.R.L. broadcasts. WLK has his 1.75-Mc. 'phone going. Thanks, gang, for reports. Let's keep them coming. Your coöperation is greatly appreciated. 73.–Ed.

Traffic: W9PTU 505 VTH 31 RJF 21 HEN 89 RTN 22 OVB 10 IGZ 9.

SOUTHERN MINNESOTA—SOM, W. F. Soules, W9DCM—YNQ gets a big kick out of the A.A.R.S. KUI joined the A.A.R.S. YZW works the East coast with a 20-watt 'phone rig. MZN, our new Director, urges the gang to help out by sending suggestions and criticisms to him. Applications are coming in for the A.E.C. BN is back in the traffic column. ZNY has a new typewriter and bug. EPJ reports by radio that he is back with a kw. rig. LVG got 'phone W.A.C. GUX reports for first time. DCM is rebuilding to use a 35T final. WDL made application for O.P.S. IJN and ZMQ are new O.P.S. Congratulations. YCW, a University student, works both coasts using a single 6L6 into a broadcast antenna. ZXS has a very nice 150-watt 'phone rig. ZAD is O.R.S. applicant. The Minneapolis Radio Club elected new officers: ITQ, Pres.; RTE, Vice-Pres.; PAT, Secy.-Treas. The Faribault amateurs have decided to have weekly meetings. ATD is rebuilding and hanging new skywire. NHX is going to try 'phone. RBW is going to put his kw. rig on 28-Mc. 'phone. Lightning took a liking for MMO's receiver last summer. Lightning struck ADQ's antenna, burned 100 ft. of transmission line, blew up all the tubes, melted the copper tubing tank coil, burned out the power supplies and made a mess out of the house wiring and telephone; he is back on with a T20 final.

Traffic: W9GUX 55 YNQ 31 EPJ 12 ZNY 12 BN 8 KUI 3 MZN 2.

WEST GULF DIVISION

NORTHERN TEXAS—SCM, Lee Hughes, W5DXA—EOE leads Section in traffic and made B.P.L. for first time. DNE reports BES in Galveston has been a great help in traffic for this Section. DXA has hopes for new countries in the DX contest. FRE has been rebuilding. FAJ is still 100 per cent traffic. BKH ran schedule with BEF while XYL was at bedside of her mother. FMZ is key station between the 3.5-Mc. C.W. and 1.75-Mc. 'Phone Nets. EZY is new O.R.S. GDH is working in the 1.75-Mc. 'Phone Net. ECE helped EXO get rig on 28-Mc. 'phone. FZJ's traveling is over and he is back at home station. FXN reports for the N.T.A.C. Radio Club. The club held an all-night affair with GBC, GTM, FXN and FOR present. FOR won a prize for the best DX contacted during the night. EUY, the club station, is on 1941.5 kc. ready for traffic. DKR (Fifth District QSL Bureau) has over 8000 DX cards on hand, and over 3000 of them are for Texas stations. Send him your envelope now, if you want yours. If not, send him a card so he can destroy them and get a few of them out of his overflowing files. BKE is with Braniff Airways in Dallas. A friend of EZY's dad was visiting in EZY's home. Asked if he wanted to see the radio shack, the visitor turned out to be Ex-9EJW.

Traffic: W5EOE 624 DNE 613 DXA 511 FRE 125 FAJ 83 BKH 75 FNZ 66 CDU 32 EZY 27 GDH 22 ECE 13.

OKLAHOMA—SCM, Carter L. Simpson, W5CEZ—CEZ reënlisted in N.C.R. GFT received O.R.S. appointment; he got in on his first QRR work. EGP has been appointed Emergency Coördinator for Muskogee and QL for Oklahoma City. DTU, new O.R.S., was visited by FSP who brought along his crystal and kept schedules from DTU. FOM signed up with the A.A.R.S. CVA reports into State Net three nights a week. FRC has almost enough cards for W.A.S. FRB enlisted in N.C.R. EST received O.P.S. and O.B.S. appointments. Listen for him on 2974 kc. Mon., Wed. and Fri. at 9:00 P.M. C.S.T. EGQ is building separate rig for 1.75 and 3.9 Mc. to widen his O.P.S. activities. Tulsa

Amateur Radio Club is sponsoring move to adopt 1.75 Mc. with very low power for carrying on local QSO and operate on spot frequency for all stations in the city. It will make a nice emergency set-up, OM's, if you get some emergency-powered ones. FFW received his Class A. CEQ is on 3.5 and 14 Mc. with a pair of 838's. CFA has rig perking on 14 Mc. BLT has taken unto himself a YF. Congrats.

Traffic: **W5**CEZ 714 (WLJC 59) FSK 520 (WLJY 75) GFT 189 EGP 90 DTU 79 YJ 87 FOM 68 CVA 64 FRC 57 MK 52 GME 49 FRB 44 FBI 17 EMD 30 BJG 11 DAK 6.

SOUTHERN TEXAS—SCM, Dave H. Calk, W5BHO—I take this means of thanking you for electing me S.C.M., and would like to have good newsy reports from all the stations in the Section. MN has morning schedules from 4:30 to 8:00 A.M. with 4PL, 8HMH, 5FAJ, 5HS, 5BN, 5CEZ, 5OW, 5DNE and 5DXA; the P.M. schedules are Monday only with 22 Texas stations in A.A.R.S. drill. FJZ reports by radio. ABH is on 7 Mc. and 3.5 Mc., Monday nights, for A.A.R.S. drill with pair of 100TH's, 700 watts. BEF moved to San Angelo. FDR is active in A.A.R.S. and is assisting your S.C.M. in organizing a Section Net. DB reports McCamey has more hams per capita than any other city in U.S.—1500 inhabitants—7 licensed "hams." FLB has new crystal Super Skyrider and is consolidating with DPS on transmitter with T20's. FNE-GAG brothers are operating 7 Mc. with pair of '45's, 50 watts. BYV is on 28 and 14-Mc. 'phone with 120 watts to a pair of '10's. DB has 28-Mc. 'phone, 120 watts, and 14, 7 and 3.5-Mc. c.w., 200 watts, to pair of T55's. DOB moved to McCamey and is on 28 and 1.75-Mc. 'phone with 250 watts to a pair of T55's. ERO operates 3.5-Mc. c.w. FNQ and FWS, OM and OW, are using FNQ exclusively with FB signal on 7 and 14 Mc. from two RK-20's. The HO. Amateur Radio Club met the Galveston Amateur Radio Club in a 56-Mc. hidden transmitter hunt during Jan. AKN reports the Emergency Corps for Houston well organized and that AMX, ATW, BZO and EEX are on his Emergency Planning Committee. During Jan. the Galveston Amateur Radio Club had the pleasure of a visit from Mr. Clinton B. De Soto of Headquarters. Mr. De Soto also visited the H.A.R.C. DWN schedules DLZ and A.A.R.S. Nets.

Traffic: **W5**OW 1607 MN 1093 FDR 351 FJZ 30 ABH 12 BEF 7 CVQ 47 DWN 88 (WLJX 197).

NEW MEXICO—SCM, Joseph M. Eldodt, W5OGJ—GEY secured Class A ticket. GUZ is working on 56 and 28 Mc. FJE is on 14 Mc. with a pair of tens final. GSJ is working the best DX around Albuquerque. FAG is in 14-Mc. 'phone and c.w., also 7-Mc. c.w. GPV joined A.A.R.S. AOP is on 14-Mc. 'phone. 3DPE/5 operates from FAG. GSA is on 14 Mc. Traffic reports are better, but news items are lacking. Let's have plenty of them, gang.

Traffic: **W5**ZM 303 (WLJG 170) GEY 274 ENI 191 (WLJI 12) DLG 44 FSP 32 GPV 11.

MIDWEST DIVISION

IOWA—Acting SCM, Phil Boardman, W9LEZ/WLUD—The Iowa-Illinois Amateur Radio Club of Burlington is conducting school on radio theory, and getting emergency net formed. The Campus Radio Club of Iowa State College in Ames will soon have new rig with pair of HK-154's. Their club boasts 20 hams from all parts of the U. S. A. The Council Bluffs Radio Operators Club meets at the Chieftain Hotel. DEA of Charter Oak is new R.M. for western Iowa. All who are interested in an IOWA Section Net, please drop him a card. New O.R.S.: MZF and LEZ. This is another record-breaking report, and all who contributed their bit are herewith thanked. IBR, QAQ, QFZ, THC, YYF and PDM are all on 1.75-Mc. 'phone in Council Bluffs. QGW is planning to join 1.75-Mc. 'phone gang. UQJ works 28-Mc. DX. RAG has a pair of '46's on 3.5 Mc. VVC has new 7-Mc. zepp. RQG and SQM have T55's on 14 Mc. and work VK's regularly. YRO has a pair of T20's. RAU, IQR and 2CMI/9 are working on new club rig in spare time. 8CGR/9 has portable at school. 9VIS, ZDS, TBD, NZW and NWF all have rigs on the air at Iowa State College at Ames. SQD is using club rig. 6LOA/9 will soon be on at Ames. 5GPW/9 reports for the Iowa State College boys. LEZ is N.C.S. of special frequency A.A.R.S. Net. DEA is organizing Section A.R.R.L. Net. Stations interested, please write him. REH is going places with traffic. AWH visited the S.C.M. DUA joined married ranks. TTO is active in A.A.R.S. YBK has new all-band rig. ACL worked several G's on 7 Mc. ABE is anxious to get a.c. and QRO. YMZ has new Super Sky rider. QHN is trying hard to get out on 28 Mc. QGF is due to be RM3c in N.C.R. VRA is whipping the N.C.R. unit into fine shape. DJR is blossoming out with kw. YWG is club station of Charles City gang. SRQ is using '03A on 3.9-Mc. 'phone. SCV is now living in Marshalltown. GEB likes his HRO Jr. for 7 Mc. VIT now has a.c. power. SCW rebuilt exciter unit. OHK is puttering around a little on 28-Mc. 'phone. NTW works plenty of DX with only 75 watts. KWY, BFB and BNG are having lots of fun with 3.9-Mc. 'phone round tables. YQY worked K6 for first DX. VRG is using new rig. OSO has pair of 809 modulators. WGC is interested in u.h.f. police work. GPB is going on 28-Mc. 'phone. TJA rebuilt speech equipment. UGT and POY are on 28 Mc. YRO is building transmitters. ZTV bought 14-Mc. crystal. LDH worked OK1 and VS5 on 7 Mc. WMM has all-band rig with pair of T20's. ARE, BGU, CTQ, QGU, FSH, NLA, PBV, PHA, PJR, RZV, SHY, TMY, WMP, WNL and WTD are all members of Burlington QRR Net on 1.75-Mc. c.w. under Coordinator WTD. Power limit, 45 volts and not over 2 tubes. Best DX, 30 miles with .027 watts input!!! Nice work, boys. BJP worked D4 on 3.5 Mc. NHY works ZL and K6 with a punk antenna. AJA, our biggest DX man, reports conditions very good lately. CEN is back on 3.5 Mc. JRY gave talk on xtals to club. 8KEY and 9TOP visited Council Bluffs Club. VTQ is back home. CFQ needs Asia for 'phone W.A.C. UFL is still on 56 Mc. BLM is planning 3.5 and 7 Mc. GMM is now 60TJ (7277 kcs.) SEE is building 28-Mc 'phone. PGG and CCY schedule 60TJ. REV is still on 3.5 Mc. SCM and UZE are on 3.9-Mc. 'phone.

Traffic: **W9**LEZ 316 (WLUD 147) DEA 190 REH 136 AWH 54 NVF 31 DUA 29 TTO 26 JMX 16 YBK 9 TGK 8 ACL 6 ABE 2. (Nov.–Dec.: **W9**NVF 95.)

KANSAS—SCM, Harry E. Legler, W9PB—Route Manager UEG reports that former Okla. S.C.M., 5GF, is now located in Hutchinson. Rebuilding of VQG into relay rack still did not prevent him from handling traffic. ZJA inquired of WDD about joining N.C.R. WIN qualified for O.R.S. and worked VK3XB, who used only 6 watts input from batteries. DKB has new portable rig on 1.75 Mc. with 220 watts. QHP, new call at Hays, got his ticket Thanksgiving Day. QLI is the new call at Eldorado. BYV is working up a 7-Mc. Traffic Net with EJD and ZFN (ex-5BOP). ZAW got an 809 for Christmas and reports traffic from 7-Mc. work. ZFS changed his final to P.P. 807's. MFH, with WIN, is giving Wichita good traffic service. SIL's first traffic report is excellent. UQX, President of Wichita Club, tells about club plans for emergencies. WRK applied for basic membership in A.E.C. BEZ has installed a low-drift 100-kc. Bliley standard frequency bar in his multivibrator for Official Observer work.

Traffic: **W9**UEG 99 ZHH 35 SIL 30 MFH 28 VQG 15 ZAW 14 BYV-ZFS 7 EJD 3 YAH 2.

MISSOURI—SCM, Letha Allendorf, W9OUD—There is a lot of 1.75, 14 and 28-Mc. 'phone activity in the state. Traffic is doing nicely, but our DX WX-man ARH says conditions were poor the past month. OWQ is joining the A.A.R.S. VMH says 3.5 Mc. is a swell band. KEI tried 14-Mc. 'phone. HVT has new O.P.S. appointment. T.L. "H" is starting operations again, and JAP is on the line. KLJ is working T.L. "M," A.A.R.S. and other schedules and will report on the river stages for the WX Bureau. BDX is on again and making use of his R.M. post. SBR is organizing the net for the WX Bureau. Mrs. TGN and the twins are away on a visit, and the OM is still working on the new rig and the emergency net. TCM has emergency rig nearly ready. PYF reports the Hannibal E.C. Net ready to work. KEF is working on St. Louis and Cape Girardeau, and JMV is doing FB for Columbia. The club there has meetings and lessons once a week. AFH and ZGX have been loaned to the southeastern Nebraska Emergency Net for 1.75-Mc. 'phone work. AIJ has graduated from a '03A to P.P. '10's in his final and is on the new Atlantic and Pacific Trunk as well as running the Mo. A.A.R.S., and has joined R.C.C. Butler has four hams now—ZOY with a pair of T2O's on 1.75-Mc. 'phone; ZXX consistently on 28 and 1.75-Mc. 'phone; BRN building 100-watt rig for 'phone and c.w. on all bands; ARA on 14-Mc. 'phone; one of his brothers is 6NRV. CJB reports the O.A.R.C., successor to the Jefferson County Radio Club, now includes the counties of Jefferson, St. Francis, St. Genevieve, Perry and Iron, and meets one Sunday afternoon each month. VMI has a new transmitter for 1.75 and 3.9-Mc. 'phone. CJB is on 1.75 Mc. exclusively. VLP, the traffic boss, has a new pair of T20's on 7 Mc. UYD has a T200 and PR15 on 28 Mc.

(*Continued on page 104*)

Standard Frequency Transmissions

Date	*Schedule*	*Station*	*Date*	*Schedule*	*Station*
Mar. 4	A	W6XK	Apr. 8	A	W9XAN
Mar. 11	A	W9XAN		B	W6XK
	B	W6XK	Apr. 15	A	W9XAN
Mar. 18	A	W9XAN		A	W6XK
	A	W6XK	Apr. 22	BB	W6XK
Mar. 25	BB	W6XK		A	W9XAN
	A	W9XAN	Apr. 23	BX	W6XK
Mar. 26	BX	W6XK	Apr. 24	C	W6XK
Mar. 27	C	W6XK	Apr. 29	A	W6XK
Apr. 1	A	W6XK			

STANDARD FREQUENCY SCHEDULES

Time (p.m.)	*Sched. and Freq. (kc.)* A	B	*Time* (p.m.)	*Sched. and Freq. (kc.)* BB	C
8:00	3500	7100	4:00	7000	14,000
8:08	3600	7100	4:08	7100	14,100
8:16	3700	7200	4:16	7200	14,200
8:24	3800	7300	4:24	7300	14,300
8:32	3900		4:32		14,400
8:40	4000				

Time (a.m.)	*Sched. and Freq. (kc.)* BX
6:00	7000
6:08	7100
6:16	7200
6:24	7300

The time specified in the schedules is *local standard time at the transmitting station*. W9XAN uses Central Standard Time, and W6XK, Pacific Standard Time.

TRANSMITTING PROCEDURE

The time allotted to each transmission is 8 minutes divided as follows:

2 minutes—QST QST QST de (station call letters).

3 minutes—Characteristic letter of station followed by call letters and statement of frequency. The characteristic letter of W9XAN is "O"; and that of W6XK is "M."

1 minute—Statement of frequency in kilocycles and announcement of next frequency.

2 minutes—Time allowed to change to next frequency.

W9XAN: Elgin Observatory, Elgin National Watch Company, Elgin, Ill., Frank D. Urie in charge.

W6XK: Don Lee Broadcasting System, Los Angeles, Calif., Frank M. Kennedy in charge.

WWV Schedules

EACH Tuesday, Wednesday and Friday (except legal holidays), the National Bureau of Standards station, WWV, transmits with a power of 20 kw. on three carrier frequencies as follows: 10:00 to 11:30 A.M., E.S.T., on 5000 kc.; noon to 1:30 P.M., E.S.T., on 10,000 kc.; 2:00 to 3:30 P.M., E.S.T., on 20,000 kc. The Tuesday and Friday transmissions are unmodulated c.w. except for 1-second standard-time intervals consisting of short pulses with 1000-cycle modulation. On the Wednesday transmissions, the carrier is modulated 30% with a standard audio frequency of 1000 c.p.s. The standard musical pitch A=440 c.p.s. is also transmitted from 4:00 P.M. to 2:00 A.M., E.S.T., daily except Saturdays and Sundays, on a carrier frequency of 5000 kc., power 1 kw., 100% modulation. The accuracy of the frequencies of the WWV transmissions is better than 1 part in 5,000,000.

Brief

W5NW, West Gulf Division Director, reports that in 1924 he had worked all states with a 202 and received all cards except from Nevada. W5NW has worked 10 of the A.R.R.L. Directors and all headquarters officers.

(*Continued from page 101*)

YTW is on 1.75 Mc. with T20 and RME59. TZX and ZEO are also on 1.75 Mc. WRD is on 7 Mc. ZVL has new 'phone rig. QMF and QLT are new calls in the club. RZN's new mast was too long when completed to come out of the basement. QJE and QJP, new hams in Joplin, joined A.A.R.S. along with SOM and BMS. OUD is trying to keep things straight, and somehow made B.P.L. in the bargain. Nice report, fellows, and thanks.

Traffic: W9OUD 520 AIJ 366 KLJ 287 PYF 191 KEI 157 TGN 72 BDX 46 VLP 40 SBR 34 EFC 33 JAP 21 CBJ 20 UYD 18 YTW 17 TCM 15 VMH 10 TZX-ZWO 11 WRD 3 ZVL 1.

NEBRASKA—SCM, Samuel C. Wallace, W9FAM—DI says Trunk Line "B" is going FB; for rag chews he uses 3.9 and 1.75 Mc. Trunk Line "L" is working from here to east coast FB; but west end broke off due to illness of EKQ. UHT is keeping bunch of good schedules in the A.A.R.S., and the Nebraska Net is working very FB now. POB is busy giving lessons on how to bust A.A.R.S. ciphers. SDL is new O.R.S. EHW is doing quite a bit of rebuilding. TBF keeps a bunch of good 'phone schedules. WKP says the Southeast Radio Club is meeting at individual homes and having good meetings. Emergency net is being organized. ZFC is rebuilding for more power. ZHJ is working for W.A.S. QGE is new reporter. PGA has taken over Trunk Line "E" schedule. He is a new O.R.S. and very capable man on this trunk line. VRT is getting a flea-powered rig ready for operation. RFQ reports for first time. EDI is busy as State Net Control for the gang here in Nebraska.

Traffic: W9BNT 1075 DI 396 FAM 337 UHT 332 POB 118 KPA 70 SDL 46 ZUM 22 EHW 7 TBF 5 ZFC 17 QAT 9 ZHJ 12 QGE 31 PGA 49 RFQ 1.

CENTRAL DIVISION

ILLINOIS—SCM, L. John Huntoon, W9KJY—BVY had a personal visit from CE1AR, who had talked to his mother at BVY's previously. RPE is President of South Town Amateur Radio Assn., Chicago. PSP is modulating the new Hammond electric organ just purchased by DXX! State Traffic Net, spot-frequency 3765 kc., is doing nicely. MLJ is installing a Pierce oscillator. OLN has new commercial radiotelephone first ticket. In the A.R.R.L. QSO party, ZEW knocked off his 42nd state. KJX reports ZB1P, Malta, RST 439X on 7020 kc., as a tip for the DX'ers. NIU finally received his license modified for the new location. YL WWP hated to return to the U. of Ill. after Santa brought her a new rack for the transmitter, an 809 for the final and a new receiver! HQH likes his new QTH—he worked his first African and Asian to make W.A.C. The long-awaited card from PAØGN finally arrived at KMN. TSN and SG were elected Chairman and Vice-Chairman, respectively, of the Chicago Area Radio Club Council at the January annual meeting; PNV was reinstated as Treasurer and your S.C.M. is now Secretary. AA's code classes are still popular. MWU has taken over organization and control of a radiotelephone net in the Sixth Corps Area, A.A.R.S., on 1887 kc.; write him if interested. Listen for O.B.S. transmissions from EC on 7 Mc. PLL reports TYH gone to Kansas City to study for an airline job. RWS enjoys making the B.P.L. NFL also managed B.P.L. The Rockford gang is mostly on 56 Mc. according to BRY. EQX has new crystal mike. We all wish a speedy recovery for MKS, who recently was operated on. Starved Rock Radio Club is sponsoring a QSO contest similar to the Sweepstakes contest for its members, and would appreciate contacts—watch for them the week of February 21st to 26th. We need Coördinators for League emergency preparation to help organize groups of hams in cities over 25,000 population, conduct portable tests, etc. If you can help us we would be glad to send you the dope. Write the S.C.M.

Traffic: W9RMN 811 RWS 625 NFL 510 PLL 451 KJY 435 (WLTK 273) HPG 283 (WLTI 136) EC 184 NXG 114 MWU 96 DDO 66 VEE 61 (WLTO 9) MRQ 39 GMT 35 SG 28 DOU 24 MCC 16 KMN-WWP 12 NN 8 HQH 6 NHF 4 KJX-NIU 3 ZEW 2.

INDIANA—SCM, Noble Burkhart, W9QG—AB had a fine time in A.R.R.L. QSO Party. ABB now has 76 countries. AWU uses 6L6 final. AXH got a B5 rock for Christmas. DJJ is trying 1.75 Mc. DLM's Jr. op. is beginning to pound brass. DSC is busy on a 200-watt 28-Mc. rig. EGQ handled some important traffic direct from EL2A and OX2QY. FTQ uses three 6L6's—T20 final. HBD is operated by Marion Amateur Radio Assn. at Marion Airport with 500 watts on 3.9 Mc. in I.R.G. Net; operators are HBD, ZDH and OYD. HFB is officer in C.C.C. Camp in Merrill, Oregon. He will be on 28 and 14 Mc. in about a month; give him a call, fellows. HIU had a 3-hour QSO with 5DRR. HPQ rebuilt shack and has new T125 final. IOB works 1925 kc. JIY helps I.R.G. KHC-IDZ erected antenna tower and built new transmitter for 28 Mc. using P.P. 55's in final, and is also building c.c. rig for 56 Mc. KQZ uses '10's parallel. LJQ will be on with P.P. RK-20's. LNH is new O.R.S. LOF worked ZS's. LYK is coming back on the air. MCH punches out with a 6L6. MIP got married. Congratulations. MTZ puts 70 watts into a 6L6. MUR has new Jr. op. at his house. NQJ is one of the 1.75-Mc. 'phone boys. OET works crossband with TTA. OYD modulates an FB carrier. PIF visited LSZ. PPB is building up on 28 Mc. PQL will be on A.A.R.S. schedules soon as he gets that Utah kit built up. SYJ has new emergency communications net lined up in Ohio River Valley. TBE punishes '46's. TBM handles lots of traffic. TRN has new 45-ft. pole in the back of his lot and put up 120-ft. doublet and 14-Mc. Johnson Q. TYF applied for O.R.S. UNS got on 28 Mc. with 80 watts to P.P. '10's. URX is on 1.75-Mc. 'phone. VPN is on 14-Mc. 'phone. WCE worked two K6's and three ZL's. WGU is new officer in N.C.R. WRC works 1.75-Mc. 'phone from Greenwood. ZBK joined N.C.R. ZBR has new HRO Sr. ZBT works 3.5 Mc. ZNC's genemotor played out, but he is back on the air with B batts. ZNZ is at Brindfield. ZUW uses T20 final. New officers of the Kokomo Club: Pres., MIG; Vice-Pres., MCH; Treas., YUJ; Secy., TTA. The Indianapolis Radio Club moved again—this time across the street to St. Paul Episcopal Church. CYQ and ex-W9CUD left for a month's trip to Yucatan.

Traffic: W9ABB 83 DET 3 EGQ 11 FB 1 HPQ 7 HUV 2 MUR 14 NGS 44 QG 121 (WLHL 160) SYJ 17 TBM 133 TE 16 TYF 5 UNS 2 YWE 9 ZNC 6.

KENTUCKY—Acting SCM, Darrell A. Downard, W9ARU—Although the Ky. Section hasn't been in print much during the past several months, activities haven't ceased by any means. As a matter of fact, we have more active stations in Kentucky at this writing than we have had for a long time. Regardless of on what frequency you listen, you can hear Ole' Kaintuck' going to town. Being active on KYN brought ZJS his O.R.S. certificate. YMX pushes 200 watts into a T55. UEC is busy building 'phone rig to tune of pair 211's. Portable 8IDX assists. BAZ, ARU and Bob Kessack of L. & N. Telegraph Dept. took in the Tenn. State Net annual meeting at Nashville and had one swell time. Ask them about Lucinda! VBO can't seem to stay put; first he's in Lexington, then Owensboro. EDQ works Trunk Line "B," KYN, A.A.R.S. and L. & N. Net and still has time to be S.C.M. reporter for Northern Ky. OMW-UTO are still QRL with baby girl. UUR is on 56, 28 and 14 Mc. TLZ is working DX on 14 and 7 Mc. NAR gets on 1.75-Mc. 'phone. UTQ may change QTH to Louisville. MN is rebuilding and increasing power. GJE is pushing a 6L6. C.W. numbers three to one in Bowling Green. Yeh! There're FOUR stations in town. EI is going strong in KYN. HAX is still on A.A.R.S. and KYN. CDA has a new Super-Sleuth 6-band receiver that keeps him up nights. 4EFY is now located at Paducah. BEW has two transmitters and receivers on the air. WXL has Class A tag. Write BAZ is interested in 1.75-Mc. 'Phone Net in Ky.

Traffic: W9BAZ 719 ZJS 527 ARU 355 EDQ 263 RBV 105 CDA 71 HAX 89 MYL 36 BEW 23 MN 13.

MICHIGAN—SCM, Harold C. Bird, W8DFE—R.M.: Bob Kolb. Michigan Eights: ONK is rebuilding. MTE keeps busy with A.A.R.S. LSF tops the traffic bill with the largest report the S.C.M. has ever seen. CSG worked D4ORT on 3550 kc. QND has a big power supply now. GQZ has a T55 final. RGU is a new reporter. FX moved to new QTH. CPY wants schedules on "1¼ meters." NUV is back with the QMN gang. IXJ has taken unto himself a wife. Congrats, OM. JZD is keeping nice schedules on QMN and 7 Mc. He reports new station, RAE at Western State, also new organization there known as Twin City Radio Council. MBM and OCC are getting QMN crystals. GP reports the new portable receiver for D.A.R.A. is complete and ready for use; 5-tube super operating with vibrator supply from 6-volt battery. NQ is still rebuilding. RDK, ex-910V, will be with us soon. ARR is back again. NXT says nothing much doing on early net, so is figuring on making it a late one. FWU is still down in old Florida basking in the sunshine; he reports meeting S.C.M. down there. BRS went through station with a fine-tooth comb from keyhole to feeder bushings—also nice power pack for receiver. NQS is putting up new skywires. QYK reports most of his activity on 7 Mc. QH and

FTW report by radio. RHD, new reporter, is using dry batteries for power on account of no power lines near QTH. Michigan Nines: CWR is back working again. CE reports PDE on U.P. Net. HSQ applied for O.R.S. GJX applied for R.M. appointment in U. P. SQB has new rig. YPI reports in QMN Net when WX right and works U. P. Net regularly. Did you notice the B.P.L.'s this month? Thanks a million, boys.

Traffic: **W8LSF** 1036 CLL 672 CEU 384 FTW 154 (WLTJ 40) DYH 147 DPE 131 BRS 96 JZD 91 QGD 82 NDL 67 CPY 58 FX 43 MTE 39 GUC 30 (AARS 155) PLC 29 CMH 27 GQS 24 ARR 21 MBM 18 NIV-QH 14 NUV 10 RGU 12 IXJ 10 CSG 9 DSQ 3 LAK 5 RDK 4 BQA-NQ 3 JUQ 1 NXT 6 BML 3 QZV-HKT 2. W9CWR 142 SQB 82 CE 49 YPI 37 HSQ 23 GJX 15.

OHIO—SCM, E. H. Gibbs, W8AQ—HCS makes the B.P.L. for the fourth successive time—this time with a record-breaking total. Our hats are off to you, Bill. LZK may leave Ohio for Dixie, and we'll lose an outstanding traffic man. PSF's fun is in proportion to traffic total—nice fun! PWY-PZA must keep the rig running all day. LVU has taken over Trunk "M" duties. JJY has new exciter unit and new receiver. HMH built swell little portable rig. LZE married a YL from Ky., Dec. 26th. Congrats, Harold. AVH has been appointed Emergency Coördinator for Cleveland and NYY for Akron. EEQ is using both 3.5 and 7 Mc. The Section welcomes new O.R.S.: PIH of Mansfield, DWT of Carrolton and GVX of Trinway. GVX was formerly O.R.S. in Wis. under call 9SES. MQO is on more regularly these days. LVH has been busy with Westlake R.C. banquet work. ORY, new reporter from Cinci., runs 35 watts to an 801 on 7 Mc. GVX built field strength meter and located antenna trouble. BAH reports new U.S.N.R. Net on 3555 kc. nightly at 7:30. KNP has returned from Michigan. RIX, new reporter from Canton, gets out well with his 802 with 35 watts. HFR has been appointed R.M. for southwestern Ohio. LWT of Oak Harbor and PVW of East Akron are new O.P.S. QBF and NYY helped out in connection with storm emergency in Michigan. MFV worked all districts in an hour on Jan. 9th, and lacks Utah for W.A.S. on 1.8-Mc. 'phone. EQN built a rotary antenna for 56 Mc. CVZ worked XE2FC with 100 watts on 3.9-Mc. 'phone. PBX got a new SX-16 from Santa Claus. PKS built a two-channel exciter for his 100TH. NYP schedules YA1HA in Afghanistan on 14-Mc. 'phone. PUN built some new measuring equipment. LKU is active on 3960 and 3924, as are KNF on 3930 and 14,172 and EMV on 3952. PVW has new YL op. born January 2nd. FB. GMI has really started the 14 and 28-Mc. rig. Cinci Club contact derby was a big success. DXB is casting his eyes about for 14 and 28-Mc. array. JTI is on again. OJN reports considerable 56-Mc. activity and some 112-Mc. activity in Akron. PNJ worked his first G on 28-Mc. 'phone, 35 watts. KKH is erecting new 50-foot lattice masts. LTI is building new rig. FSK has new crystal rig on 56 Mc. FHB got the bugs out of his rig. Fostoria Wireless Assn. is now organized and going strong. CDR is having fun with controlled carrier. JFC schedules ZT6M daily on 28-Mc. 'phone. JEX has many QSO's with 7 watts to a single 6A6 rig. A thief entered AFZ's station and stole a NC100X, a smaller receiver, several crystals and a pair of headphones. If any of the gang run across any of this equipment, please notify AFZ, who offers a reward for its recovery.

Traffic: **W8HCS** 2120 LZK 341 PSF 245 PWY 206 LVU 166 CIO 140 (WLHC 149) LCY 113 UW 108 (WLHI 161) HMH 93 LZE 80 PZA 78 QBF 65 BBH 58 (WLHA 465) EEQ 57 PIH 54 MUR 52 AQ 43 MQO 39 MFV 37 DWT 26 KIM 19 NKU-EQN 17 LVH-NYY 15 CVZ-ICC 11 YX 10 ORY 9 APC 8 PBX 7 GVX-HFR 6 PKS-BAH 5 NYP 2 PUN 3 LKU-PVW-GMI 1.

WISCONSIN—SCM, Aldrich C. Krones, W9UIT—DPR has been reporting into net regularly. DXI is building portable. HDP is building new 'phone and c.w. rig. PSC is still calling his dog on 1.75-Mc. 'phone. RZY gets on 1.75 Mc. in the wee hours of the morning. WYT is going full swing on 1.75 and 3.5-Mc. c.w. ONI and NRQ are doing fine in State Net. PQY is getting the bug again. HSK is using 6L6 and RK-20. EXH likes the local round table QSO's. YEX rebuilt. EWY likes the new PR15. GWK leads the state in traffic. RNX will have new two-inch oscilloscope and a.v.c. speech amplifier soon. Madison Radio Club has new B.C.L. Interference Committee. RQM made fine score in A.R.R.L. QSO Party. HGG is reporting regularly in Trunk Line "A" and State Net. SZL is doing fine job holding down his spot in State Net, N.C.R., A.A.R.S. and T.L. "J." SJF had good time in A.R.R.L. QSO Party. The S.C.M. would like to see more interest shown in A.E.C. and traffic work, especially in Milwaukee. M.R.A.C. has been very fortunate this year in having OUB and SO on the Program Committee. They have arranged some of the finest talks ever heard at a ham club.

Traffic: **W9**GWK 262 NRQ 17 ONI 40 (WLTN 20) SJF 4 HGG 27 SZL 115 (N.C.R. 23) UIT 12 HSK 49 (WLTD 64).

ROCKY MOUNTAIN DIVISION

COLORADO—SCM, Glen R. Glasscock, W9FA—This month seems to be about tops for traffic reports, a total of 22 stations reporting. Nice work, gang, keep it up. It would be appreciated if the traffic reports would be split up into originated, delivered, relayed, extra credits, and total. I want to take this opportunity of thanking those who send in group reports; TDS, the YL at Rocky Ford, for the Arkansas Valley reports; EHC for the Pikes Peak region reports; 9TOX for the Ft. Collins reports; 9ECY for the collection of reports at the store; 9DDF for the Army 'Phone Net reports. ESA certainly keeps the ether hot. RVW has been doing a little double duty because EKQ has been on sick list. WWB and TDR let folks know that Pueblo is on the map. TDR says tests with the complete battery-powered rig were very successful. EAM has the bug again and is building a new transmitter. The P.P.A.R.A. gang is raising money to install a 100-watt 'phone in the new club room. They put on a 20-min. program at KVOR recently in behalf of amateur radio, and say they are getting plenty of publicity in the local newspapers. EHC operates on all bands from 28 to 3.5 Mc. working schedule with ZCX, and took part in A.R.R.L. QSO party. FXQ put the 6L6-RK20 rig in enclosed rack. HDU is building a 100TH final. NHI is in charge of erecting the Radio Club's new antenna. NRZ is a faithful 28-Mc. enthusiast. OKY, the P.P.A.R.A., has a new AGS, and the 6V6-807 rig is complete and installed in the new club room at the Strang Garage. PRF has the rig working on 3.5-Mc. 'phone and c.w. QBG is getting new Sky Chief receiver. UEK is operating 1.75-Mc. 'phone and 3.5-Mc. c.w., also making room for HK154 in final. VHN cannot put up a rig at home, so he will keep the P.P.A.R.A. station busy. WXK added a '10 final to the '45 osc. YLT had such good luck with a 36 e.c. osc. running at 8 watts input that he is giving the 6L6's a rest. YYO is building a super-het. ZCX plats to modulate T55 rig with 212E. ZIZ bought power supply to run a pair of RK12's in modulator. ZKM is trimming his rig a little to get it on 28 Mc. ZKT has plans drawn up for new transmitter. ZXU is proud papa of a Jr. op. TLM is heard on 1.7-Mc. 'phone. PWU is rebuilding for higher power. YDW is Boulder outlet for Colo. A.A.R.S. 'Phone Net. UJS has new rotary beam under construction. BTO has the bug to put up beam antenna. 6CTH-9 is proud possessor of new 38 Super Skyrider. ZOD is getting rig ready for 28-Mc. DX. ZEF has a pair of new 809's. IGM is working portable from Montezuma. PIY has the 1-kw. rig perking. SEX spent holidays at home and had the rig on the air most of the time. RHH is on 28-Mc. 'phone with a 6L6. TOS sold his Super Skyrider and now uses an FB7A. TOW has the antenna and stove installed and is ready to get back on. TOX bought the Skyrider from TOS. ZDZ likes new 101X very much and has pair of 809's ready to go. ECY schedules WVB and PPU. CAA keeps daily schedule with ICC which was of much benefit to ICC when his mother-in-law (in Denver) was seriously ill. TTD is rebuilding JJU's transmitter and keeping busy on the air with about seven schedules a week. VGC says "QRL 29180 kcs." YFM gets time for about three contacts a week. NWW is QRL on 29022 kcs. 85 per cent rag chewing. FUH got back from vacation in Calif. and brought a new Hallicrafters SX17 with him. LQO keeps the YL contingent well represented in the A.A.R.S. ranks, as well as maintaining a bi-weekly rag chew with her chum, TDS. GLI finds time to be on N.C.R. drill every Tuesday. MDN and TDS had GLI and LQO for Christmas dinner; later in the day 8BB, FDP and ex-9OYE dropped in and they had a regular hamfest. FDP is now living in Denver, where he is employed by the Weather Bureau. JJU entertained R.F.A.R.A. gang at its annual New Year's Eve party, and everyone reports a swell time, with plenty of waffles and sausage to start off the New Year—well fed. VQY is operating portable in Placerville. WVZ at Marshall Pass is postmaster, weather observer, and telegraph operator for D. & R. G. at that point, and has plenty of time for radio. Any of you fellows who need a little assistance in getting traffic over the hump, just get in touch with him. DSD built up a P.P. 6L6 rig for N.C.R. quarters and is getting things together for the P.P. 211 stage.

A Double-Regenerative Superhet

(*Continued from page 18*)

signal is obtained by using a regenerative detector and a separate b.f.o. than is obtained by turning off the b.f.o. and making the second detector oscillate, another argument in favor of the separate b.f.o.

No trouble should be experienced with image response. The presence of images simply indicates that the antenna coupling is too tight, and loosening it should cure the trouble. A separate tuned antenna circuit [2] also will help reduce image response, but it adds another control and also makes the regeneration setting of the mixer more critical, and is therefore not recommended except where absolutely necessary.

This receiver was designed for the fellow who now owns a regenerative receiver and wants something better. In order to get the reaction of that type of amateur, the receiver was "farmed-out" to a W1 who has worked considerable DX in spite of having only a t.r.f. receiver. He was asked to be as critical as possible, giving his honest reaction and experiences. After a few days he brought the receiver back to complain about the "jumpy" tuning previously mentioned, a fault that hadn't shown up in our laboratory adjustments. The fault was corrected as described, and our friend returned to his shack. He tells us that the signal-to-noise ratio is much better than with his t.r.f., that he can hear many signals he couldn't touch before, and that he can now work right up close to the big fellows without their locking him up. There is only one thing he didn't tell us. He failed to mention when he will return the receiver.

[2] Exp. Section, "Tuning the Receiving Antenna," *QST*, June, 1936. Also Chapter Seven, *The Radio Amateur's Handbook*, 1938.

W9AXH

(*Continued from page 44*)

transmitter; and a Triplett modulation indicator and carrier-shift indicator. The microphone is a Brush Type BRS-2.

Two Q antennas are used, one a half wave on 14 Mc., the other a full wave. They run at right angles to each other and are supported by two 65-foot telephone poles plus a smaller iron pole. A Ward-Leonard antenna relay is used to shift the antenna in use from transmitting to receiving.

Since the latter part of April, when the transmitter was finished and put on the air, contacts have been made with many foreign countries, most of them being the "100%" type. Most of the operation is carried on with an input of 650 watts, although the full kilowatt is frequently used. At the maximum input the final r.f. tubes show so little color that the glow on the plates can be seen only in a darkened room.

The call W9AXH was issued to its present owner in March, 1923, and a station of one type or another has been on the air ever since. The transmitter shown here is a far cry from the lone 202 which comprised the first outfit!

Hamdom

(*Continued from page 51*)

desire to please by public appearances and the wish to withdraw to his blessed privacy. His college class is like a family, and they live with an astonishing community of interest and experience and inspiration. He eschews ponderous professional formalities. His radio class, indeed, spends many of its hours (in class and out) in his private ham shack (it is really a laboratory). These are his intimates, and with all such he is regarded as the king of choice spirits. Strangers find his reserve a bit difficult to penetrate; this is not because he wishes it so, but because the contours of his thought processes fall in lines too lofty and direct for immediate understanding.

He is a man who will be a legendary figure. About him legends have already arisen—legends perpetrated by students, by colleagues. These legends are not malicious, nor are they wholly untrue. They are bits of fiction erected on small bases of fact. They are entertaining mosaics which are built and re-built as they are told, and to which new pieces are constantly added—it being but natural to add bright, shiny pieces to so fascinating a pattern. This situation disturbs the good doctor at times, but he consoles himself with the reflection that it doesn't do any real harm.

The cause is probably that highly-selective memory of his again. People ask him for details as to what he has done, and he can tell them of the technical ramifications, but such puerilities as names and dates and places he cannot tell them. He was honored, once, for his inventive genius, with an elaborate banquet, and speeches, and a medal. Before that, they asked him for biographical details; but he could not please them. So they went to the dean, and he prepared a long and impressive list, and the doctor was as interested as anyone to hear it. It was probably accurate enough, at least in broad outline, he feels; at any rate he hopes so. They gave him a medal, but it was lost, and now he has difficulty recalling the name of the society. He belongs to several Greek-letter fraternities, and has turned down bids from others; but he cannot immediately recall the names of any of them. Why burden himself? There are so many more important things to remember and to think about.

An ideal breeding-ground for legend, that attitude. It leads to attempts at interpretation, and interpretation leads to theorizing, and theorizing leads to romancing. Apart from the legends, however, his career has been extraordinary. He has held numerous patents, but his major contributions (mostly in the field of electric railway engineering) he has never patented. He has given them into the public domain. He has not even sought the publicity attendant upon the presentation of formal papers (sometimes to the dismay of the college authorities). He merely tells his ideas to other people. In this informal way he has served as consultant to many railroads and manufacturing firms. For the most part he passes his

ideas on to his students, and they work them out. Many times they become final theses. His work and his ideas are spontaneous and often ingenuous. In 1913, just before coming to Penn State, he evolved an automatic street car control system for interurban train service. In 1914 he sketched out an improvement, and his senior class made a model and tested it. It seemed appropriate to call the early version the 1913 model and this the 1914 model. But in two or three weeks the 1915 model was out, and by the time America entered the war they already had the 1939 model on the bench. Then they stopped, but it has always been a question whether there were no more improvements possible or whether the prospect of an eventual futuristic Frankenstein daunted them.

This species of dry, indeed at times quaint, humor is ordinarily remarked as Dr. Woodruff's most notable characteristic, especially in amateur circles. At times it is a depth bomb, exploding only slowly in the consciousness of his hearer. At other times it is a skyrocket, sizzling upward and gaining momentum until it, too, achieves full meaning and explodes. But never is it labelled, obvious.

The freedom with which he contributes his ideas to the world and the reserve in which he holds his private affairs are in sharp contrast. When the State of Pennsylvania inaugurated the licensing of engineers not long ago, he refused to make application. The examiners required the submission of details concerning previous commissions and activities, and he would not tell these things. Nor did he believe any engineer should be forced to do so. His conviction was that the relationship of consultant to client was like that of any other professional man—lawyer, or doctor—a confidential one. He still does not have the license.

Of course it is always appropriate to tell of a man's interests. Dr. Woodruff has had many, and has pioneered in several fields. He has been an amateur photographer since 1899. He has owned twenty-three cars since 1908 and has driven across the continent twenty-five times; travelling over long routes at high speeds has always been to him a major satisfaction. He is a trained musician, having graduated from the University School of Music in Ann Arbor; his particular musical interest is the pipe organ.

But radio has for some years past been increasingly the focal point of his life. He began it in 1897, thus encompassing practically the entire history of the art. On his wall still hangs an elaborate spark gap constructed in 1910—operated at 40,000 volts and capable of a 4-inch spark. The call 8CMP was issued just after the war, and it has since been consistently active. The recent handicap of arthritis does not deter Dr. Woodruff from religious maintenance of several traffic schedules and active participation in all A.R.R.L. operating activities. At that, he usually finds time for a little extra rag-chewing with new stations on the side, swinging his bug with enthusiasm rivalling that of the newest ham. During the winter he plans to invade the realm of 10- and 20-meter 'phone, planning thus

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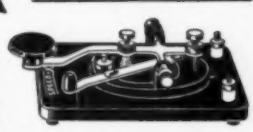

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to satisfy himself concerning certain technical problems arising there.

President Woodruff is doubtless best known to hams in general for his famous "bag o' tricks." He is an indefatigable constructor of unique pieces of apparatus with novel and ingenious applications—all of which he builds himself, to the last detail—and these he has exhibited at conventions and hamfests in practically every state. Indeed, Doc Woodruff and his blue Duesenberg with the call W8CMP on the trunk, in which he accomplishes his convention hegiras, have become a tradition at ham conventions.

His connection with A.R.R.L. dates back to 1925, in which year he was elected director of the Atlantic Division, succeeding such well-known figures as the late Horace Beale and Dr. G. E. Bidwell. Consistently re-elected, by 1936 he had become the dean of the League's Board. As such he was chosen as the chairman of the Board for its first meeting following the double loss of President Maxim and Vice-President Stewart. So effective was his performance in this capacity that he became the Board's choice for the presidency, and he took office immediately upon election in May, 1936.

As was said before, Dr. Woodruff is an individualist. He believes in individualism. His creed is that the mass cannot rise higher than the individual unit, and it is therefore the unit that must be trained and developed. The keystones of civilization and culture are enterprise and ingenuity, he feels. It is this conviction which forms the basis for his intense faith in amateur radio as a force for good. He sees in the training which the art of amateur radio has afforded so many thousands—young and old, of all walks of life, in lines of thought and action—a concrete force of incalculable good. He recognizes that there must be an outlet for latent energies above and beyond those required for the simple acts of living, and he believes that these outlets can be made to lead in any direction—good or bad—solely through the pressure of environment of habit. The cultural discipline of amateur radio in shaping such outlets is, inevitably, certain to advance the broad front of civilization as a whole.

Such is the destiny he envisions for amateur radio. The amazing counterpoint is that his own life and accomplishments so ably illustrate that vision. —*C.B.D.*

How Would You Do It?

(*Continued from page 50*)

6-32 tap so the tip may be threaded onto the screw. If a tap is not available, the threads of the screw may be filed off until the 'phone tip may be slid on over the screw and soldered in place. Contact to the tap is made by means of a standard 'phone jack which will also fit on the No. 12 or 14 wire.

Still another scheme is shown at K. This idea comes from W2GSI. A contact from a small knife switch, properly formed to fit the wire, is fitted to a standard Eby binding post. This post has a hole passing through the shaft which will pass No. 12 wire. The clip may be slid along the wire to the desired point and tightened by the clamping action of the binding post. The wire support, which also serves as the lead to the tap, holds the clip at right angles to the axis of the coil.

We believe the idea shown at L deserves honorable mention. While it seems that the idea must have been used before we have never happened to see it. An ordinary small soldering lug is soldered to the wire and then almost any type clip will provide good contact with little danger of falling over on adjacent turns, or the wire may be fastened on with a machine screw. If taps must be made on every turn, the lugs may be staggered. This idea comes from W8NDV.

Thanks also to the following whose schemes could not be presented because of space limitations: W2DOD, 2GNE, 3BFK, 6JEI, 8GWF, 8HKT, 9BSP, 9EGE, 9IKY, 9YZH, VE1KE and H. C. Hawkins.

Rules under which the contest is conducted are as follows:

1. Solutions must be mailed to reach West Hartford before the 20th of the publication month

Problem No. 15

THANKS to the suggestions of his many friends, Our Hero's radio equipment is working very smoothly (for the time being, at least), in fact, perhaps a little too smoothly for one of his nature who delights in tinkering. It now happens that he would like to install his rig in the basement or in that special shack he has had in mind for so long. The YF, however, visualizes climbing flights of stairs or long trips to the shack whenever she would have a word with him. Our Hero thinks he ought to be able to find most of the necessary material in his junk box with which to build an inter-communicating telephone system between the shack and the house, thus solving the difficulty. He would like to see diagrams with all values of the simplest system which will work satisfactorily on lines up to 100 or 150 feet in length.

of the issue in which the problem has appeared. (For instance, solutions of problem given in the April issue must arrive at *QST* before April 20th.) They must be addressed to the Problem Contest Editor, *QST*, West Hartford, Conn.

2. Manuscripts must not be longer than 1000 words, written in ink or typewritten, with double spacing, on one side of the sheet. Diagrams must be neat and legible.

3. All solutions submitted become the property of *QST*, available for publication in the magazine.

4. The editors of *QST* will serve as judges. Their decision will be final.

Prizes of $5 worth of A.R.R.L. station supplies or publications will be given to the author of the solution considered best each month, $2.50 worth of supplies to the author of the solution adjudged second best. The winners are requested to specify the supplies preferred.

Hints and Kinks

(Continued from page 54)

Fig. 5 shows the connections. The values shown are for the rig used here, a 59 keyed oscillator and push-pull RK-20 amplifier. Assuming that R_1 and R_2 are proportioned to give the desired bias, the adjustment of the relay operating current is simple. Turn on the bias supply and apply normal excitation to the amplifier. Leave the plate voltage off so you won't run the risk of becoming a Silent Key. Adjust the shunt resistor until the relay just closes. If the relay does not close, the resistance of R_3 is too low. The system is now ready for use. Turn the excitation and bias supply on and off a few times to make sure the relay works every time.

It can be seen that the amplifier plate voltage cannot be applied until the bias and excitation have reached the proper value. Thus, if the excitation or bias fail when the power is turned on, the amplifier won't go up in smoke.

Now we come to the disadvantage of the 3-ma. opening current of the relay and the reason for the shunt resistor. Taking the rig here as an example, assume the shunt resistor disconnected, no excitation, the power is on and the relay contacts are closed. Now suppose a partial short develops in the bias supply. Depending on the resistance of the short, the current through the relay will be between zero and the normal bleeder current of 12 ma. At the relay opening current of 3 ma., the bias on the amplifier will be around 22 volts, which would allow the plate current to climb way above normal. Now assuming the same conditions, but with the shunt resistor connected, the bias will be around 45 volts. By applying excitation now, the resulting grid current will bring the bias up to around 67 volts, which is a little over half the normal bias used on this amplifier. This would hold the plate current to a reasonable value. The higher the ratio of shunt resistor current to relay current, the higher the bias voltage will be at the time the relay opens. Any dead shorts or opens occurring in the bias supply will cause the relay to open immediately.

—Norman C. Hunter, W4DBF

A Continuously-Rotatable Beam

(*Continued from page 46*)

The brass collar should be fastened about 3 feet 9 inches from the bottom of the 1-inch aluminum pipe to allow 3 feet 6 inches for fastening to the mast and 3 inches clearance for the pulley and ropes. The 1-inch aluminum pipe supports the whole affair and is anchored to the two upper pyrex insulators with a heavy-gauge brass strap which completely encircles the pipe. The bottom end of the pipe is anchored to a single pyrex standoff insulator with a heavy brass mounting screw through the pipe. Also, a hole is drilled at this point and tapped for a 10/31 brass machine screw which connects the stub to the antenna. The four vertical bracing members (two each side) are bolted in place to make the entire framework rigid, and they eliminate the possibility of the top horizontal member's lagging behind the bottom one and snapping the director and reflector from their support. Lengths of both reflector and director are adjustable.

Wherever possible, brass hardware is used to withstand the weather, and all wood members are heavily varnished. The rope used is a good grade of hemp. From the bottom pulleys the rope ends come into the shack, where the rig can be operated merely by pulling the ropes. Alternatively, the rope can be fastened to a wheel for more convenient rotation; you will most likely want to incorporate your own ideas in the rotating control. Since only a few pounds of tension are necessary to rotate the beam, we simply pull the ropes here. Our indicating device consists of two flashlight bulbs tapped across a few inches of the director and reflector—a green bulb in the director and a red one in the reflector.

The drawings and photograph clearly show all other details. The methods for adjusting the quarter-wave linear transformer and coupling the transmission line are described in the *Handbook*.

New Transmitter Design

(*Continued from page 26*)

gain amplifier of this type the importance of carefully shielding the mike cord and plug is generally realized. Many microphones are now furnished with a shielded plug and cord as standard equipment.

POWER SUPPLY

The single power supply which serves both the exciter and the audio amplifier has to be considerably huskier than if individual supplies were used. The cost of building a single husky power supply offers quite a saving over that of two separate power supply units, however, even with the special heavy filtering required. Aside from being designed to handle the combined power requirements of the audio and r.f. circuits, it is quite conventional. Oil condensers are used, rather than electrolytic, as the operating voltage

is of a value that is slightly in excess of what may safely be used when complete freedom from breakdown or failures is desired, especially after long periods of inactivity.

The switch on the front panel for interrupting the plate supply without interfering with the filament heating, for use when receiving, is provided with additional contacts at the rear of the cabinet so that it may also be used either directly or by means of relays to turn off and on the standby switch on the receiver and the plate supply to the final amplifier.

APPLICATION NOTES

For convenience, the exciter-speech amplifier unit really belongs on the operating table, alongside the receiver. This permits locating the final amplifier, modulator and power supply at relatively remote points, for instance in the basement, in a closet or similar available space. If only one final amplifier is used, then of course it is necessary to shift plug-in coils or go through some other such maneuver in order to change bands. With all the band-switching convenience built into the exciter, it is felt that there is considerable merit in the idea of having more than one final stage—at least one for each of the most-used bands. Then by means of a relay, remote lighting of the filaments in the stage desired can be controlled from the operating position, and band-switching in the final accomplished with as much facility as in the exciter.

The investment in equipment for such a setup is not as great as might be thought at first, inasmuch as the same modulators and power supply would be used for all bands.

The Cover

THE photograph this month was taken in *QST*'s laboratory where Ross Hull is working toward the development of some simplified ham television gear. The image on the Kinescope suffers several obvious faults but at least it is an actual un-faked, unretouched image. Some of the fuzziness is due to the very long exposure (one minute) made necessary by the use of a small stop to give adequate depth of focus. The source of the image is a standard picture generator tube made by the Allen B. DuMont Laboratories.